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VOLUME XX | MARCH 16, 1931 | NUMBER 5

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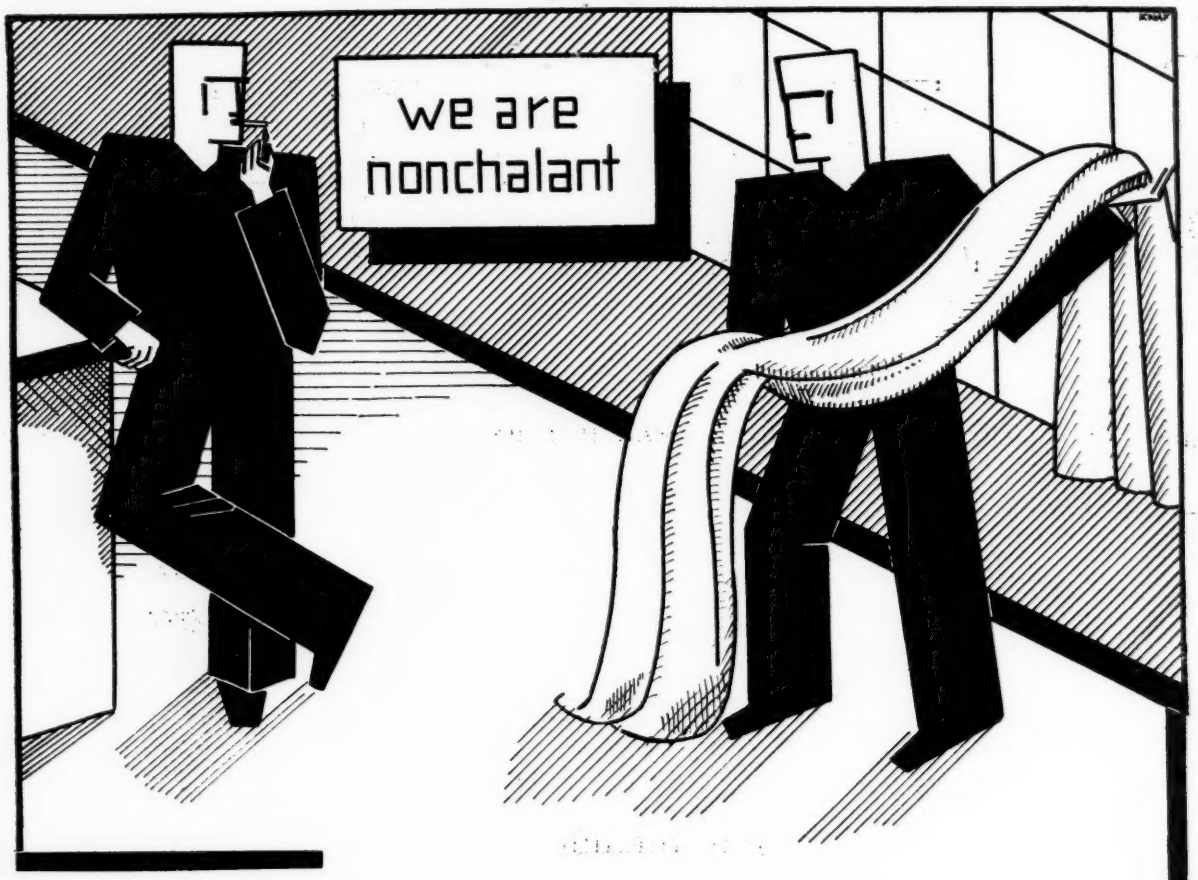

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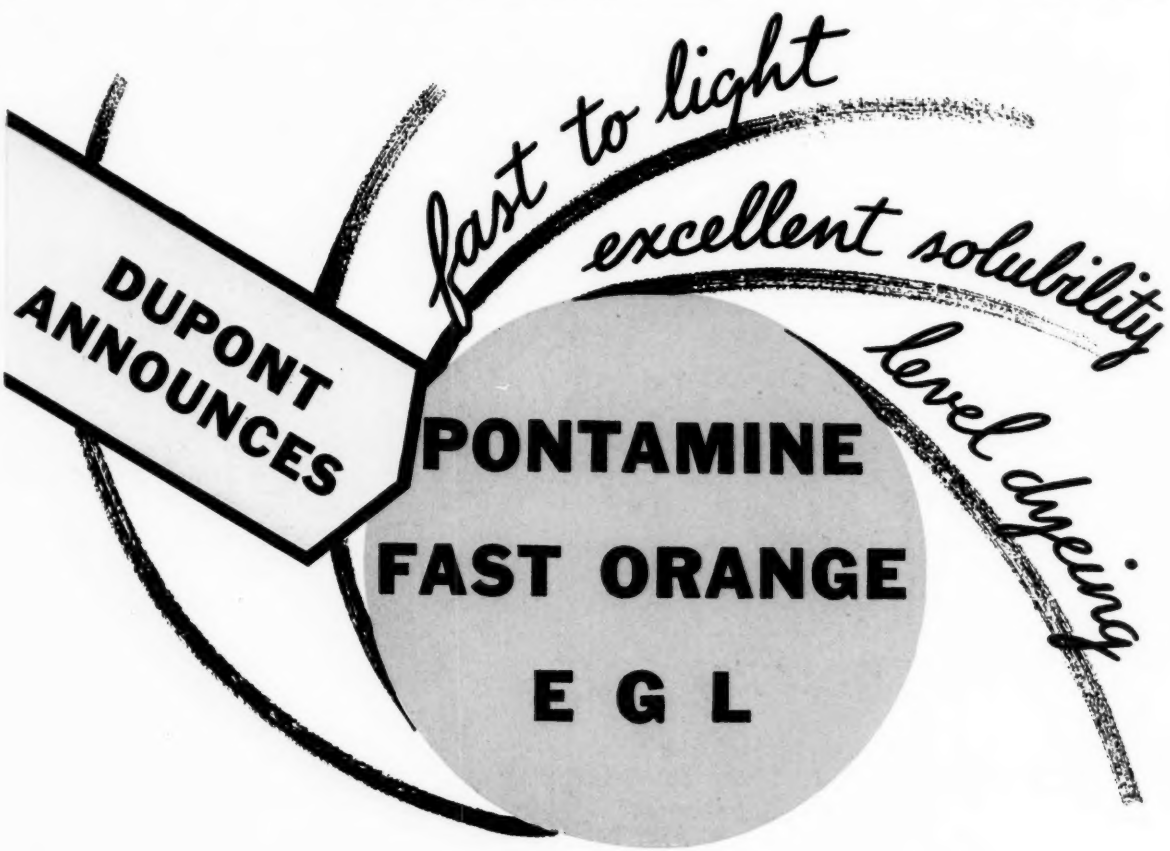

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Volume XX | MARCH 16, 1931 | Number 5

The Generating and Application of X-Rays for Textile Investigations

By Herman Boxser

RECENT developments in the field of X-ray photography have broadened the scope of this late implement of scientific investigation to utilize its powers not only for medical and biological aids, but also to serve industrial research. Thusly, in the latter scope, the X-ray has been used to great advantage in metallurgy, in the analysis of coals, and, in fact, wherever knowledge of invisible interiors of objects without their alteration has been desired. The major application of the X-ray for textile research has been confined almost entirely to the investigation of the micellar structure of cellulosic fibers. These results have appeared during the past few years in scientific literature and their appearances will undoubtedly multiply with time since the X-ray promises to be an outstanding appliance of textile research. This is especially true of textile fibers which have been subjected to various finishing operations as wetting-out and dyeing, and also those fibers subjected to the action of the various chemical reagents utilized in their processing. In the following, the writer has attempted from bibliographical data to describe the properties of the X-rays, X-ray apparatus, and also methods for producing diffraction patterns.

X-rays, which were discovered by Roentgen in 1895, fall within the category of electromagnetic waves, which include such familiar rays as ultra-violet, infra red, radio and electrical rays. The only difference in these lie in their wave lengths which lends unlike properties to all. The principal properties of X-rays are (1) they move in straight lines and may be diffracted like light, (2) they affect photographic plates, (3) they excite fluorescence in some substances, (4) they ionize gases, and (5) they are unaffected by magnetic fields.

X-rays are created by the impact of cathode rays (electrons) upon matter within a high vacuum. In order to generate X-rays an apparatus must be produced, the essential parts of which consist (1) a source of electrons proceeding from a cathode, (2) a target or anode often called the anti-cathode in X-ray terminology, and (3) a means of applying a potential difference between the cathode and target which will accelerate the electrons to the requisite velocity during their passage across the intervening space. These compose the principal parts of an X-ray bulb.

The source of electrons is that of an electric current, the potential difference being created by use of either induction coils, storage batteries, or alternating current high tension transformers. Of these sources the last is utilized at present to the greatest extent. Storage batteries involve a great expense. If the alternating current high tension transformer is used other devices for the stabilization and rectification of the current are also employed in conjunction with it.

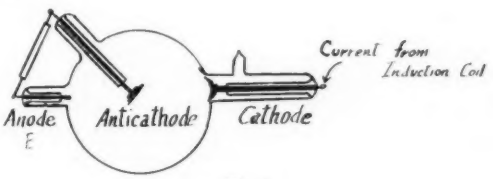

Fig. 1
Simple X-Ray Tube

In Figure 1 there is shown a diagram of a simple X-ray bulb. It will be noted that there are two anodes present. Anode (B) is not an absolute necessity to the apparatus since the X-rays may still be generated without its presence. Both the cathode and anode (B) are made of aluminum, while the anti-cathode is molded from platinum. The cathode is grooved concavely in order to focus the electrons upon the inclined

anti-cathode from which the X-rays are refracted in the highly evacuated bulb. Since a high heat is produced by the generation of the rays from the anti-cathode, the latter has a tendency to melt. To counter-react this, the anti-cathode is made either as massive as possible, or a cooling device is attached to it as will be shown in a subsequent diagram.

One of the greatest recent developments in the progress of the X-ray tube has been the introduction of the Coolidge X-ray Tube. In this tube the flow of electrons is activated to a great extent by a hot wire cathode. Due to the extremely high evacuation of the tube (1000 times the ordinary tube) the latter subsidiary electron-emitting cathode must be resorted to since the flow will not occur by the ordinary method, as described previously. Figure 2 shows a cross-section of the hot cathode. It consists of a small flat spiral of tungsten wire surrounding which is a molybdenum tube, the two being electrically connected. The tungsten spiral is heated by a subsidiary electric current (storage batteries), thus becoming a source of electrons, which increases rapidly with rising

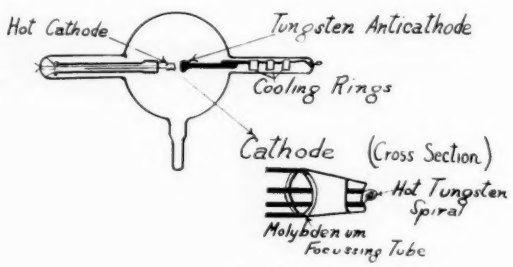

Fig. 2
Coolidge X-Ray Tube

temperatures of the spiral. The purpose of the molybdenum tube is to focus the stream of electrons on the anti-cathode, which is made of a very heavy tungsten. No additional anode is necessary in this tube. A voltage of 30,000 volts is usually employed to operate the tube. A diagram of this tube is shown in Figure 2.

In a most recent address before the Radiological Society of North America, Professor George L. Clark of the University of Illinois described the untold possibilities of the X-ray which were created by the use of a new X-ray tube introduced by himself and his colleagues. The tube operates on a voltage of 50,000 volts, which cuts the time of the taking of the X-ray pictures from two hours to one-fiftieth of a second. The new tube may be termed a super-microscope since it presents diffraction rays revealing molecular structure, rather than direct photography of planes. The taking of the pictures is so rapid that motion pictures of molecular changes may be made on a fluorescent screen. The tube is not made of glass, but is all metal containing pinholes through which the X-rays pass.

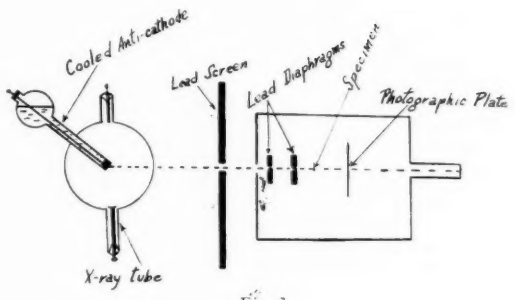

Fig. 3
Friedrich and Knipping's Diffraction Apparatus

In the foregoing we have attempted to describe the actual generating of the X-rays, and in the following touch upon the use of these rays in obtaining diffraction patterns of crystallites.

A simple apparatus for the diffraction of X-rays is shown in Figure 3. This is a device evolved by Friedrich and Knipping. Here the X-rays from the tube are cut down to a narrow beam by the lead stops, which are impenetrable to the rays. The latter thence pass through the crystallite and subsequently fall on the photographic plate.

Clark's apparatus for producing diffraction patterns which is shown in Figure 4 has appeared previously in this journal. In this method the X-rays are also cut down to a narrow beam by the lead pinholes and after passing through the specimen are photographed on the plate.

The photographic effect of X-rays on sensitized films is not unlike light rays. X-rays produce darker spots on the film, and consequently a much thicker coating of a halide is used on the film. The rays emitted from the X-ray tube are invariably narrowed by lead stops to produce a flat beam of X-rays which then impinge on the photographic film. Sometimes the film is bent into an arc, at the center of which the specimen is located. The diffracted beams are then received on all sides.

An insight as to the theory of the production of diffraction patterns may be gained from the excellent information of Sponsler which is contained in the following:

When X-rays are directed on a crystallite at a slight angle, the effect is as though the rays were split into two beams,—a strong one which passes

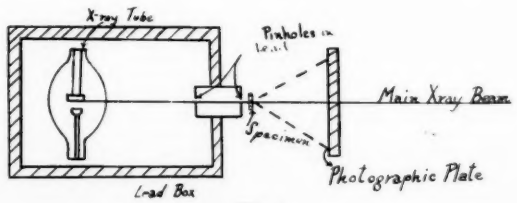

Fig. 4
Laue Pinhole X-Ray Apparatus

through the crystal in a straight line, and a weaker one which is deflected at an angle equal to the previously mentioned glancing angle. There are three factors, the relations between which must be definitely adjusted before the desired effect is produced. These are (1) the wave length of the rays, (2) the glancing angle of the latter upon the specimen, and (3) the distance between the atomic planes of the specimen.

In a crystallite there exists a considerable number of atomic planes which lie parallel to the crystal face and separated at equal distances. These planes cause the deflection or diffraction of the X-ray beams. Thus, the diffracted beam does not come from a single atomic layer, but is an additive composition of many weak beams, each from one of the parallel layers. Therefore, the intensity of the beam will depend upon the number and kind of atoms of the planes and also the location of any secondary planes that may be present. The diffracted beams are reflected to the photographic film on both sides of the principal beam (the above mentioned strong beam which passes on through the specimen in a straight line), and the resultant photograph is called a diffraction pattern.

Diffraction patterns to the untrained eye may appear as coarse and indistinct representations of the interior structure of crystalline matter. The physical chemist, however, by use of physico-chemical laws has retraced the dimmed patterns with the evolution of a clear picture of heretofore unknown structures.

Textile fibers, particularly cellulose, fall into the category of colloids, whose particle size is of much larger dimensions than that found in the crystals of the simpler inorganic compounds as NaCl or KCl. In the examination of colloids by use of the X-ray, it has been found that the smaller the particle size, with a consequent fewer diffracting planes, the less perfect will be interferences, and also the resultant patterns much broader. Therefore, by measuring the diffraction breadths in the patterns it has been possible to calculate the magnitude of the particles in cellulosic fibers. Physical chemical equations have been formulated for this calculation in which the wave length of the ray, the edge length of the specimen considered as a cube, angle of diffraction and breadth of the diffraction in the pattern must be known.

The examination of textile fibers differ from that of crystals in their shapes and flexibility, and also in the fact that their intricate structures make the interpretations of the X-ray diffraction patterns quite complicated. In order to obtain strong diffraction lines it is necesary to pack thousands of fibers parallel into a bundle perhaps three or four millimeters thick. If the fibers are not parallel the resultant patterns will be of every imaginable orientation. This parallel arrangement of the fibers may be likened to a crystal where the operator is afforded a control of the position of the planes. A set of diffraction patterns is considered complete after a dozen photographs in which different relationships are caused to exist between the X-ray beam and the axis of the fiber (atomic planes) have been taken.

The necessity of the latter procedure was found by Friedrich and Knipping in their pioneer X-ray investigations of crystals. An unusual deviation in diffraction spots from the primary beam was noted in the examination of a stationary crystal. If the crystal was moved in a direction parallel to itself the groupings of the spots in the pattern were unaffected. However, if the crystal was rotated, so as to produce a different angle with the primary beam, the pattern was so affected that symmetrical groupings around the center spot were obtainable.

The X-ray has revealed much in offering explanations for the physical properties of fibers, such as tensile strengths and extensibility. From diffraction patterns of various rayons, X-radiologists have been able to predict the characteristics of these fibers. Reactions of cellulose with other chemical compounds in which the physical characteristics of the former has been altered have been investigated with interesting results. According to the X-ray, mercerization is but a physical rearrangement of the crystallites in the fiber, and in the acetylation or nitration of cellulose, there is unlikeliness of the formation of a complete new chemical compound. In other words, a cellulose acetate fiber may be considered as a mixture of cellulose and cellulose acetate, in which case the conversion of the former to the latter compound is not complete.

Yet there exists a remarkable field for the application of the X-ray in the finishing of textiles. Here the investigations would not only include examinations of processed fibers, but also of solutions. Heretofore, the X-ray had been used mostly in investigation of atomic structures of solids and consequently data on the manner in which solutions, especially colloids, diffract X-rays has been meagre.

The importance and predominence of colloidal dye sols in the finishing of textiles is well known. Examinations of these by the use of the X-ray would undoubtedly reveal considerable hidden phenomena. It has been found that X-rays themselves flocculate certain colloids. In noting a sol of Benzopurpurin 4B, Freundlich found that the sol underwent definite spontaneous structure formation. Applying these results in a physico-chemical manner to colloidal vat dyes, one may see the possibilities in establishing a definite relation between optimum reduction of the dye to the leuco state, particle size of the dye in this state, and its maximum adsorption per fixed concentration by a cellulosic fiber.

In printing we have still another fertile field for X-ray investigations. Colloidal gels, which are con-

tained in printing pastes, have been shown by the X-ray to be partly amorphous and partly crystalline. By heating and stretching, the gels show a structure similar to stretched rubber, i.e., crystalline. The gels have been found to possess a micellar structure like that of cellulose, in which dye particles are held. It would be interesting to observe the revelations by the X-ray of the varying conditions of the dye particles and gel, in respect to each other and towards the fiber, immediately after printing, following the aging and steaming, and also on final drying.

The X-ray is a comparatively new tool of industrial research and its use for investigations in the textile industry appears limitless. Undoubtedly, at some future time it will become a common aid for unraveling the many intricacies which arise in the processing of textiles.

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A Quick and Useful Horizontal Tank Chart

By W. F. SCHAPHORST, M.E.

HERE, at last, is a chart that gives the gallons of liquid in any horizontal tank without the use of tables, formulas, figures, or computations of any kind.

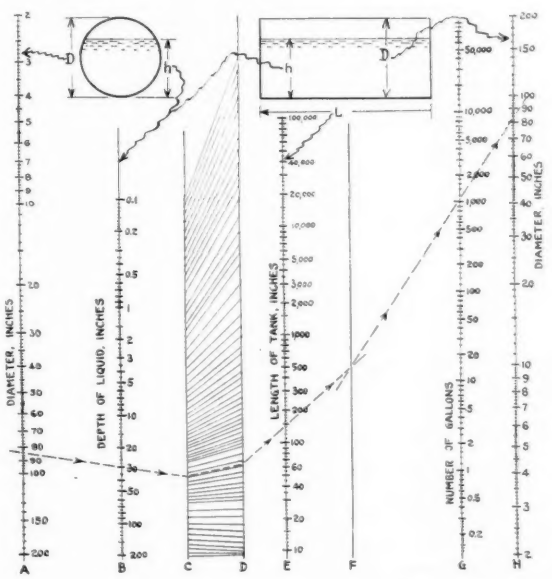
Simply start at the left and zigzag a ruler or thread across the chart three times as demonstrated by the dotted line and the number of gallons is immediately found in Column G. For example: How many gallons in a tank 84 inches in diameter, the depth of liquid being 30 inches, and the length of the tank being 142 inches?

Run a straight line through the 84, Column A, and the 30 in Column B and locate the intersection with Column C. By means of the eye follow the radiating "guide lines" to Column D, locating a second point of intersection. From this latter intersection run through the 142, Column E, and locate the point of intersection in Column F. Then from this point run over to the 84, Column H, and the intersection in Column G will be found to be close to 1,050 gallons, which is the answer.

One of the great advantages of this chart is that it takes care of any depth of liquid from 1/10 of an inch to the full capacity of the tank. All guesswork is eliminated. To make the chart absolutely clear the writer has included sketches showing the diameter of the tank D, the depth of liquid h, and the length of tank L with wavy arrows leading from them to the proper Columns. By following them no mistake can be made.

The range of the chart is amply wide. It will take care of any diameter from 2 inches to 200 inches and of any length of tank from 10 inches to 100,000 inches.

This chart will give an answer much more quickly than tables or formulæ. It is surprisingly accurate. It is more complete than tables because it takes care of every



dimension between 2 inches to 200 inches whereas tables generally skip many diameters and lengths giving only 24", 28", 32", 34", etc.

To avoid confusion all dimensions are given in inches.

Since Column E takes care of lengths of tanks up to 100,000 inches it is plain that not only will this chart compute tanks but it will include long pipes whenever it is desired to compute either the full capacity of such pipes or their partial capacity. 100,000 inches is equal to 8, 333-1/3 feet.

Inversely the chart may be used very conveniently for determining the length of tank necessary to hold a given number of gallons where the diameter of tank and depth of liquid are known or fixed quantities as is often the case. The method of applying the chart to problems of this character is so obvious that further directions are unnecessary.

Proceedings of the American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Council and Research Committees—
March 20—Boston.
April 10—New York.
May 15—Boston.

* * *

Exhibition of Color at the Museum of the Peaceful Arts, 220 East 42nd Street, New York. Starts January 2nd and continues several months.

* * *

New York Section Meetings—
March 27—Paterson.
April 24—New York.
May 22—Paterson.

* * *

Northern New England Section Meetings—
April 4.
May 2.

WINTER MEETING OF THE PIEDMONT SECTION

MEETING called to order at 6.45 P.M., with Mr. Samuel L. Hayes, Hartsville, N. C., Chairman, presiding, and Mr. A. R. Thompson, Jr., Secretary.

The Chairman: The meeting will please come to order. In accordance with our usual method of conducting the business we will dispense with the reading of the report of the Secretary and Treasurer, unless there is objection.

A Sectional Committee has been appointed by your Chairman, consisting of Messrs. S. I. Parker, Clearwater, S. C., R. M. Mitchell, Greensboro, and Malcolm McKenzie of Charlotte. The officers of the Section, as most of you know, are members of that Committee ex-officio.

The Sectional Committee held a meeting this afternoon. The first point of business brought up was the question referred to the Sectional Committee at the last meeting. A communication was read at that meeting requesting the Piedmont Section to hold its fall meetings on alternate years in Greenville, S. C., during the week of the Textile Machinery Show. That was referred at the last meeting to the Sectional Committee, and at the meeting this afternoon a resolution was passed to the effect that inasmuch as the present officers will end their terms next fall—do good if they last that long—and the new Sectional Committee will be in office at that time, we did not feel that we had jurisdiction over the matter. We therefore tabled

it and will pass it on to the new officers and the new Sectional Committee, who will have a full year to decide the matter.

The next question to come before this meeting is the question of the annual meeting of the American Association of Textile Chemists and Colorists in 1932. I am going to ask our Secretary to tell you something about the invitation which he extended at the Chattanooga meeting.

Mr. Thompson: At the meeting of the Association in Chattanooga on the first Saturday in December they brought up the question of the coming conventions in 1931 and 1932. The 1931 meeting was awarded to Boston, Mass., and 1933 was awarded to Chicago, to be held during the coming World's Fair, and I realized that unless we availed ourselves of the opportunity of having the annual meeting in the Piedmont Section following the Boston meeting, it might be another six or eight years before we had any chance of securing it for this section of the country, so without any authority from the Section, I took it upon myself to extend an invitation to the Council, subject to the confirmation of this Section, to meet with the Piedmont Section during 1932. That invitation was recorded by the secretary of the Council and they are awaiting our confirmation or rejection, which I hope you will decide upon tonight definitely. They are perfectly willing to come to the Piedmont Section, because they had such a good time in Charlotte at the annual meeting in 1927, and seem anxious to come back.

The Chairman: I might say that Mr. Thompson presented that to the meeting of the Sectional Committee this afternoon. The Sectional Committee approved Mr. Thompson's invitation and in accordance with their custom they recommend to the Piedmont Section that they approve the action of the Sectional Committee in approving Mr. Thompson. A little roundabout, but that is the proper way to do it.

The Sectional Committee recommends to the Piedmont Section that the Secretary be instructed to formally and officially invite the National officers to select the Piedmont Section as a meeting place for the 1932 annual meeting. The Sectional Committee further recommends that nothing be done at this meeting as to the selection of the town in the Piedmont Section which will have that meeting. That will give the various towns three months in which to present their applications. I might say informally that two towns have already put in a bid for it. It is recommended by the Sectional Committee that the town in which to hold the annual meeting in 1932 be selected at the next meeting.

I think a motion is in order that this recommendation of the Sectional Committee be adopted or rejected.

On motion, duly seconded and unanimously carried, the recommendation of the Sectional Committee is adopted.

The Chairman: I might say, if there is any one here now who would like to take not more than a minute to issue an invitation for the annual meeting, we will extend the floor to them. If not, we will pass on.

Mr. Stone: As a citizen of Charlotte and as a member of this Association, I hope that the city of Charlotte will be considered in connection with the meeting. Charlotte once entertained the national group, I hope with a fair degree of satisfaction, and I believe they could entertain and take care of them very much better in 1932 than they did in 1926. I extend an invitation for Charlotte.

The Chairman: Thank you, Mr. Stone. I know, from talking to two or three of the men, Charlotte will have some competition in that.

In accordance with the usual custom, I will appoint a Membership Committee. I might say that one of the men who has done a great deal for this Section called my attention this afternoon to the fact that the percentage of men who are members of this Section, as compared to the available men, is rather small. I am notifying the members of the Membership Committee that at the next meeting they will be called upon for a report, so don't do nothing and report progress.

For Chairman, Mr. Hugh Puckett of Charlotte; Prof. Grimshaw of State College; Mr. Joe Moore of Charlotte; Mr. John Crosby of Greenville, S. C.

We have with us tonight a very zealous worker for our Association. I am exceedingly proud of the fact that this particular man is here. It was my pleasure to work with him for several years, and it is the first time since the Association was formed that one of the executive offices has been held by a southern man. I think it is a tribute to the growth of the finishing industry in the south and a tribute to the growth of the Piedmont Section. At the last meeting in Chattanooga, Mr. H. A. Barnes of Greensboro was elected Vice-President of the National Association, and it is with pleasure that I call upon our new Vice-President for a few remarks.

Mr. H. A. Barnes: I thank you for the compliment and the compliment paid to the Southern Association. It is a distinct honor to be an officer in the A.A.T.C.C. Jack Crist and Bob Glenn and a lot of you fellows think I never do any work, so if you will get busy and get in a lot of new members, I will have to investigate to see whether they are eligible for membership, and that will keep me busy. We ought to have more members in the Piedmont Section, and I hope we will get them. If there is any way I can serve you, I will be glad to do it.

The Chairman: Before we dispense with the business proper, is there any new business to come up?

If not, I will turn over the meeting at this point to Mr. Sandridge, chairman of the Entertainment Committee.

Mr. Sandridge presented the three Clark Brothers,

diminutive negro boys, who sang a number of spirituals, and Mr. Leo E. Byrum of the Acme Studio of Dancing, and several of his students gave a program of dancing, the entertainment feature being greatly enjoyed by the audience. In addition to this, music was furnished during the dinner hour by the Charles Bodenhammer Orchestra.

The Chairman: There is one more point of business which I neglected to announce. In accordance with our usual custom, the next meeting will be in Greenville.

It was my pleasure one time to say a few words before a group of college students. The professor who introduced me had never heard me talk and did not know me, and he introduced me as an expert. After my talk I went up and thanked him for his introduction and told him I especially appreciated the fact that he had introduced me as an expert. He said, "Young man, do you know what an expert is?" I said, "No, what is an expert?" He said, "It is a damn fool a long ways from home."

We have with us tonight a man who is an expert, but he is not the same kind of expert I was. When you call a man an expert in his own home town, then he is an expert. We have with us tonight a man I am going to introduce as an expert, but I want you to know I am doing it in his own home town.

We are very fortunate in having with us Mr. Hill Hunter of the Proximity Mfg. Co., and I repeat, I introduce him in his own home town as an expert Purchasing Agent.

Mr. Hill Hunter then presented a paper entitled "Purchasing for Textile Mills, and Some Commercial Aspects of Same."

The Chairman: I still stand by my statement that we have with us an expert Purchasing Agent. (Applause)

Before we go on to the next number I want to remind you of the drawing which takes place a little later. As most of you know, the names of those who send in cards will be put in a hat and one drawn out, the lucky man winning this combination pen and pencil set. If the man is not in the room, it is just too bad. If he is outside, we will not wait on him. If he is not here of course he loses out.

We will take up the discussion of Mr. Hunter's paper a little later.

Before I introduce our next speaker, I am going to tell you a little joke on him. Many of our southern preachers have some good friends among the colored people. I am glad to say that our friend who is going to talk next is one of them. A colored friend who greatly admired him went up to New York recently and came back to High Point, where our next speaker resides. One day he met his colored admirer on the street, and he said to him, "Parson, you know New York is a great big place, it is a great place for a colored fellow to go" and Mr. Conrad said, "Yes, but why is it so great?" He said, "You know, up there the negroes and the white people all ride in the same street cars, and they go to the same movie shows and they eat at the same places and they sit on the same bench in the church." Rev. Mr. Conrad said, "You don't mean they sit on a bench in the church, they sit in a pew." The colored friend said, "Yes, yes, that's right, you know that day I went to church there I sat by a white lady, and when I sat down she turned around and looked at me and said 'pew'."

I take great pleasure in introducing Rev. A. B. Conrad, pastor of the First Baptist Church of High Point, who will talk to us on "Contacts of Life."

Contacts of Life

By Rev. A. B. Conrad

I am very glad to be here, and you fellows might as well settle yourselves for a long stay. It so happens that for the last six weeks I have been in this town six times making speeches before numerous organizations, so I am pretty well out of gas. I am a good deal like the fellow who got in a street car, who had his face badly disfigured. He was tied up with bandages, and as he sat there the man next to him wrote on a card, "I am a skin specialist and I can cure your face" and handed it to him. The fellow read it and turned it over and wrote, "I am a nerve specialist, but neither I nor anybody else can do anything for your nerve."

I think people are pretty much like the girl who went out walking in the country with a young man and they came to where a cow and a calf stood rubbing noses, and the fellow with a lovelorn look said, "I would like to do that." The girl said, "Go ahead, it's father's cow."

I want to talk to you a little while tonight on the subject of contacts. Life is very largely made up of contacts. Our usefulness in the world is determined by the way in which we enter into life's relationships and the way in which we develop ourselves. Out from every man's life go streams of influence which affect other lives, and so it is true that no man liveth unto himself and no man dieth unto himself. The greatest danger I know about in life is this, that we shall fail to be at our best. A great number of men fritter away their lives, they do not have their eyes fixed upon the great realities which after all make life.

We are all acquainted with that story which used to be so interesting in boyhood days, the story of Robinson Crusoe, on his lonely isle, with no friendly face to look upon, there did not sound in his ears the voice of another being, he felt the touch of no friendly hand, so great was his joy one day when he discovered the footprint of a man in the sand. After all, he was not alone. That brought a thrill to him.

So, my friends, it is true that isolation is desolation and aloneness means loneliness. We come in contact with a great multitude of people. We touch other lives every day, and one of the great things in life is to make these contacts in the way they ought to be made.

All of us have our domestic, our personal, our civic, our political and our religious contacts, and the value of life is determined in the final analysis by what we are in all these relationships. A man's success in life is not determined by the knowledge he has acquired, by the wealth he has possessed himself of, by the position to which he has come, but after all a man's success in life is determined by the amount of moral and spiritual treasure which he has acquired and so a man has his personal contacts first of all. There is a good and a bad self in each of us. There is a Dr. Jekyll and a Mr. Hyde dressed up in every suit of clothes. Every one of us here possesses something that leads us to the heights and those calls come from within, very largely. Every one hears the calls that drag us downward. We feel the grip of something within ourselves that we have to contend against continually.

This is one thing we should never forget, that whatever else may come in life, a man has to live with himself, a man has to look himself in the face once in awhile, and, my friends, let me say that every one of us has to live not only with ourself, but the way in which we appreciate ourselves, come to possess ourselves or have ourselves in possession, determines in a large measure the value of our life. The test of a man is the way he stands on his feet and takes the daily bumps and blows.

"The man who backed against the wall,
Stands up erect and takes fate's blow, with his head held high.
Bleeding and bruised and pale,
He is the man who will win in the bye and bye.
For he is not afraid to fail.
It's the bumps you get and the prize that escapes your hand,
That tests your mettle and proves your worth.
It's not the blows you deal, but the blows you take
On this good old earth,
That shows if your stuff is real.

The test of a man is the fight that he makes,
And the grit that he daily shows,
The man who stands on his feet and takes
Fate's numerous bumps and blows.
A coward can smile when there's nothing to fear,
When nothing his progress bars,
But it takes a man to stand up and cheer,
When some other fellow stars.
So it's not the victory, after all,
But the fight the brother makes.

Circumstances and environment have something to do with life, but after all they do not make life. It is that which is within ourselves, that self-mastery, that noble purpose, that fixed desire for the higher and better things of life. There are some things every man not only ought to seek but some things he ought not to have in this life.

There was a traveling man one time about to become a father. He was very much concerned about it, and when he left on his trip he instructed them that as soon as the baby was born to send word, and he would come back immediately. When the baby was born they sent him a telegram, and he got on the first train and started home. It so happened that in the community about that same time there were five other babies born, and some of the good women decided they would have a little fun at the expense of the new father, so they went around and borrowed these five babies and laid them alongside his baby. When he got home he rushed into the room where his wife was, and said, "Darling, how are you?" She replied that she was all right. Then he asked, "And where is the precious little thing?" and she said, "There it is." He rolled back the sheet and there lay six babies. After a horrified moment, he exclaimed, "Great God, did any of them get away?"

Don't let anything get away in life. The man who does not have great purposes, who does not dream great dreams, who does not visualize a great life, arrives nowhere. So I say we have our personal contacts.

Then we have our domestic contacts. Home. What a wonderful word that is. How much is wrapped up in it. There are a few words that are worlds—God, country, mother, home. Home is a man's castle where he retires for rest, and there he has an experience in life that can come to him nowhere else. If home is what it ought to be, he has a foretaste of heaven.

With some people home is only a boarding house. Like the little boy who asked his mother, "Say, Ma, who is that redheaded man that comes and eats dinner here on Sunday?" All the little chap saw of his father was on Sunday at dinner. There is too much of that going on in life. I want to say to you men that the home life is the test of life, the test of a man. I read not a great while ago of a woman who died in one of the southern states, and after the sturdy sons had borne the body to its resting place in God's Acre and came back home and began to talk about the monument they would rear over mother's grave and the inscription they would put on it, and finally one daughter suggested, "I think this would be fine. Let's put on the monument the name of Mother, and then beneath it say, 'She always made home happy'." I do not know any tribute that could be paid to life that would be more noble than that. In our contacts in the home life we ought to be continually striving to make home like that. That was a sad incident in Carlisle's life. You know he was one of the great spirits in many ways, and yet he lacked one thing, tenderness. He loved but he did not love tenderly. He married a very beautiful woman, who soon learned she was a sort of clerk for him. Finally she was stricken with

asthma and grew worse and worse. One night Carlisle was entertaining two of his friends and she was breathing loudly and he said, "Jane, don't breathe so loud" and soon she stopped breathing altogether. Then began the pilgrimage to her grave, and day after day he went there, and one day some one saw him stooping over the grave and hear him say, "Oh, Jane, if I had only known, if I had only known." He ought to have known. It is every man's business to keep those contacts in the home, the most sacred in life, he ought to make happy those he is under obligation to make happy.

I suppose some men may feel very much about life as the fellow who said his wife was an excellent woman except for two things, one was that she got up late in the morning and the other was she was not good for anything after she got up. No doubt there are a great many men who feel as did the man who married a widow. After he had been married a while he bought a piece of crepe and put it around his arm. When he went home his wife said, "Why are you wearing that crepe?" He said, "I am in mourning." She said, "Who for?" and he replied, "For your first husband. I am sorry he died."

Some men may be like Pat, who drank a little too much occasionally, so his wife decided she would cure him. One night she dressed up like the devil, and when Pat came reeling home she stepped out and said, "Stop." He said, "Who are you?" She said, "I am the devil." Pat stuck out his hand and said, "Put her there, old boy, I married your sister."

I would like to say that this is not a one-sided affair. I have been arbiter in a good many domestic conflicts and I want to say that most of the domestic difficulties that have come under my observations have come about because of trifles. John said it was a rat and Mary said it was a mouse and they quarreled over something as important as that, but I want to say after a careful analysis of the difficulties I know about, usually the major part of the blame belongs on the masculine side of the house.

A good many women have the right to feel as did the woman whose husband was taken suddenly ill and she rushed out for a doctor. Finally she saw a house with a sign on it and she went in and said, "My husband is sick, can't you come?" and he said, "You don't want me, I am a veterinary, you want a human doctor, you don't want a horse doctor," and she said, "No, my husband is the biggest ass and the worst kicker in town."

I heard of a fellow who went to a fair and came home with the button off his coat. When his wife went to sew it on a card fell out of his pocket with the word "Lillie" on it. She said, "What is that?" and he had to think quick. There are occasions in domestic life when you do have to think quick. So he said, "That is the name of a horse I bet on at the fair." That settled it and he went on his way, but next night when he came home she said, "George, that horse you bet on at the fair called up this morning." So I want to say it is not all one-sided.

Then, friends, there are the contacts that come between the father and the boy. Some one has said the boy is a bundle of possibilities. A year ago my youngest daughter died, leaving a little boy, Billy. Everybody says he is a wonderful little fellow, five years old, and day after day he climbs upon my knee and puts his arms around my neck, and life means more to me than it ever did before. I read these lines the other day:

"To feel his little hand in mine, so clinging and so warm,
To know he thinks me strong enough to keep him safe from harm
To see his simple faith in all that I can say or do,
It sort of shames a fellow, and it makes him better, too.
And I am trying hard to be the man he fancies me to be,
Because I have this chap at home who thinks the world of me.
I would not disappoint his trust for anything on earth,
Nor let him know how little I just naturally am worth,
But after all, it's easier, that bright road to climb,
With the little hands behind me to push me all the time.
And I reckon I'm a better man that what I used to be,
Because I have this chap at home who thinks the world of me."

The relationships of the home, the contacts that you and I make. I wish we might all realize the importance of them.

Then we have our civic contacts. What makes the town? It is the men in it.

> Ill fares the land, to hastening ills a prey,
> When wealth accumulates and men decay.

I could tell you about a man who lived for himself, a man I know very well. When he died they said, "A rich man is dead," but that is all they said about him. He had cared nothing about the community in which he lived, he had contributed nothing to the upbuilding of the city, he was not concerned about the well-being of other men, he lived self-centered and alone, and with all he had accumulated, he made a failure of life. There are men like that in every community, men who fail to keep the contacts of life.

"Don't you know there's lots of people,
Sittin' round in every town,
Cluckin' like a broody chicken
Knockin' every good thing down.

Don't you be that kind of cattle,
'Cause they ain't no use on earth,
You just be a booster, rooster,
Crow and boost for all you're worth.

If your town needs boostin', boost her,
Don't stand by and wait to see,
If some other fellow's willin',
Sail right in, this country's free.

He ain't got a mortgage on it,
It's just yours as much as his,
If your town is short on boosters,
You go in the boostin' biz.

If things don't just seem to suit you,
And the world seems kinder wrong,
What's the matter with a-boostin'
Just to help the thing along.

'Cause if things should stop a-goin'
We'd be in a sorry plight,
You just keep that horn a-blowin',
Boost her up with all your might.

If you see some feller tryin'
For to make some prospect go,
You can boost it up a trifle,
That's your cue to let him know

That you ain't agoin' to knock it,
Just because it ain't your shout,
But you're going to do some boostin'
'Cause he's got the best thing out.

If you know some fellow's failin's
Just forget them, for you know,
That same fellow has some good points,
They're the ones you want to show.

Cast your loaves out on the waters,
They'll come back, is a sayin' true,
Maybe they'll come back buttered,
When some booster boosts for you.

So that is the way to make a town. I heard of a fellow out in Ohio who was in the boosting business. He got up to make a speech at a convention and he said, "We have the best town in the world, the biggest little city on earth. We have a soap factory in our town that makes soap so cleansing you never saw anything like it. An old farmer came in and bought a bar of this soap and went home and took a bath and his own dog bit him. We have a pill factory in our town that makes pills so efficacious that it will heal all manner of disease. There was an old woman living over the hills with her joints so stiff she could hardly walk and she took two packages of those little round pills and her joints became ballbearing. We have a patent medicine factory. The wife of one of our prominent men has a bad breath. It was so bad her husband could not kiss her. She took a bottle of that medicine and now anybody can kiss her."

Keep a contact with the community. Write this down, that the man who builds a fine house, the man who keeps a well mowed lawn, who plants a few flowers, who puts out a few shrubs, is making a contribution to the life of his community that no man can estimate. Children see it. Esthetic taste is being developed among those he knows not of in his community.

Then we have our political contacts. I want to say a serious word to you men tonight, it is this, that this country of ours is still in the experimental stage. We are about 150 years old, and it is not yet demonstrated that a government that is of the people and for the people and by the people can live for long, so far as our country is concerned. The history of all great nations demonstrates this fact. Every great nation marched out of the shadows of its birthplace and marched with heroic and intrepid step toward the high road of its life, and then grew flabbid and lawless and unworthy and turned and walked mournfully to its grave. That is history. It is the history of every great nation of antiquity, and if we walk in the same path —I am not a pessimist, I am an optimist—but I am standing here to say that if we walk in the same path we will reach the same destiny.

My friends, we need to realize a few things in this country. A few years ago the balance of power was in the country. In any crisis, you could depend upon that great middle class of people, that great multitude of people who have character and soul to come to the polls and save the day, but now the balance of power is in the city. More people are living in the cities today than in the country, and I call you to witness this, that the two great cities of this country, New York and Chicago, are at this present time in the hands of thugs and roughnecks and bootleggers and rumrunners. Law has broken down and the police power is not able to cope with the situation. That is the confession made openly in those great metropolitan cities. We must keep the contacts. At the last election it was demonstrated that half the voting power of the nation stayed at home. Men so absorbed in the concerns of their business that they did not care how it went with the State. Every roughneck in the country was at the polls and voted. Men refuse to serve on the jury and men refuse to mix in politics because it is dirty, and yet if this country is to be saved, a certain class of men must come to the fore and keep the contacts every good citizen ought to keep if this country is going to live a great while.

Then we have our religious contacts. Man is a religious animal. That always comes to the surface somewhere along. I have heard men say they are not religious, and yet when their dead lie in the house they have religion. What is the biggest thing in Greensboro and the towns all you men come from. It is not your banks, your schoolhouses, your business places or your factories, but after all the biggest thing is the church and the thing for which the church stands. Every man ought to keep contact with those things. Take the church out of Greensboro and there is not a man who would stay here two years. You would not raise a boy or girl in a place without these influences that make life what it ought to be round about them. I know the churches are sometimes cold, but maybe you do not warm any of the benches.

There was a fellow who went to church and one night the preacher said, "We will now close in prayer, and Deacon Jones will lead" and Deacon Jones opened his eyes upon hearing his name called said, "No, it isn't my lead, I just dealt." Too many people in the churches like that. We ought to keep the contacts that ought to be kept in the church and Sunday school. The church is not prospering, because there are a lot of tightwads in it.

Let me say finally this, that life is what we make it. It is not the things outside ourselves, but inside. I learned long ago there is not anything outside of one's life that can light up the soul of a man and make the days happy and joyful through all the deepening and trying experiences as they come. Things never made a man happy. One of the most tragic incidents in history is that told of Alexander, who having conquered all the world then cried for more worlds to conquer lamenting because there were no more worlds.

So, my friends, you and I must remember that if the world is not right it is because we are not right, because we are not doing what we ought to do.

There was a fellow who used to get illuminated once in awhile, and on one of his annual trips he got into a saloon and finally laid down and went to sleep. Another fellow came in and saw him and thought he would have a little fun, so he went over to the lunch counter and got some limburger cheese and rubbed it under the first fellow's nose, and pretty soon this man rolled over and as he waked up he said, "Ooh" and got up and thought he would go in the bar room where it might be better, so he went in the bar room and took a deep breath and said "Ooh," then he thought he would try it outside, and he went out in the fresh air and took a deep breath and said "Ooh," and so he walked a little further and took another breath and said "Ooh." He saw a little rise in the road further on so he staggered up to that and took another breath and said "Ooh," and turned around and went back to the saloon and staggered in and said, "This is awful, isn't it?" and the bartender said, "What is awful?" and the fellow said, "The whole world is rotten."

The world isn't rotten. If a man gets that idea of life, the cheese is on him. This is a good world and there is a good God on the throne. Things aren't going to the everlasting bowwows.

I want to say to you that man's dividends will always be in proportion to his investments. Two fellows went in a church one night and the preacher made a very touching and effective appeal for some good cause. One of the fellows had only $2.00, that was all he had, and the other man had a great big roll. I am speaking seriously. We get out and effective appeal for some good cause. One of the fellow with the two dollars said, "I ought to keep this, I need a bed and breakfast, but probably somebody else needs it worse than I do" so he dropped it in the plate. The other fellow fished out a nickel and put that on the plate. So those two fellows went their way, and in a few days the man who had put in the two dollars received a telegram from a lawyer out west telling him that a rich uncle had left him five thousand dollars, and the other fellow received a telegram saying to meet the five o'clock train, his mother-in-law was coming to spend the summer with him.

Seriously, we all have to answer for life. Some day the books are going to be opened. God is keeping tab. Psychologists and scientists tell us man never forgets anything. Everything comes back. What contacts have we made? The man who whistles makes the whole world feel like dancing, the fellow who wears a smile when he feels like crying inside, the fellow who is strong and gets the weaker brother under the shoulder to give him a lift, the man who does the deed that brings smiles, the man who lives down in the mud, walks there of necessity and yet who keeps his head among the stars, that man has succeeded. And so, men, as you go out from this place, you have had a good time together, I pray you to think about these things.

"The hounds of God across the years,
Are running swift and true,
Far and away they seem to play,
But they're tracking me and you.

The King is seated on his throne,
His courtiers stand around him,
They see him start and grasp his heart,
The hounds of God have found him.

The wicked woman wipes her lips,
And says, 'tis naught, 'tis naught,
But the velvet feet of the hounds so fleet,
Patter behind her thought.

At low midnight the wastrel wakes,
Afraid upon his bed,
The far-off sounds of the flying hounds,
Are ringing in his head.

They have torn great empires limb from limb,
And conquered the conquerors,
And their teeth have hurt for the sins of dirt,
In plagues that are worse than wars.

They have cruelly taken the old man down,
And bitten the babe at the breast,
For there's not a sin or kith or kin,
Can escape their fateful quest.

Before us goes God's angel tall,
Flying upon the wind,
Clear as the dawn he beckons us on,
But the hounds of God are behind."

I thank you. (Applause)

The Chairman: I am sure it is altogether unnecessary for me to say that we have enjoyed this talk very much. I feel sure we must all profit by it. On behalf of the Pied-

mont Section I am going to ask Mr. Conrad if he will take these flowers home and present them to Mrs. Conrad, with our compliments. (Applause).

We have had a good many difficult technical papers during the last four or five years. I do not believe we have had one that was particularly applicable to the dyeing of rayon yarns. For that reason, if for no other, I am glad we have with us tonight Mr. D. O. Gryder of the Southern Dyeing Company, Burlington, N. C. He will present a paper on "Dyeing of Rayon Yarn."

The Dyeing of Rayon Yarns

By D. O. GRYDER
Southern Dyeing Company

WHEN asked to give this paper on the dyeing of rayon it first occurred to me that it would be a simple matter to completely cover the subject from preparation for dyeing to inspection and packing. But I find it to be a subject of wide scope on which many papers could be written, particularly of each class of dyes. To me the dyeing of rayon resolves itself into two main factors.

1—The application of a dyestuff suitable to the consumer.

2—The application of this dyestuff suitable to the converter. The first of these has to do with the levelness of shade, fastness to light, washing, bleaching, etc. The second has to do with winding, warping, slashing and weaving. Both factors are unseparable, therefore the aim of the successful dyer. In this paper I will try to give some of the reasons why a dyer does not always accomplish his aim.

Let us before going farther make a general distinction of synthetic fibers. They are generally divided into two classes:

1—Regenerated cellulose, of which cupro silk, nitro silk, and viscose are the principal characters.

2—Cellulose derivatives of which acetate silk is the principal one. The first of these two classes of fibers is generally regarded as the most simple dyeing because of the adaptability of most of the dyes. However, the dyer will experience quite a lot of trouble with the mills that continually do what is called "Shopping." Invariably the different brands of rayon dye differently due to the chemical structure of the silk. Cupro silk possesses an affinity for dyestuff that easily distinguishes it from the other fibers. The rapidity with which this fiber takes up the dye makes it positively necessary to retard the dye to prevent streaky dyeings. This may be done by starting a cold bath with the addition of soap or ammonia and gradually bringing the temperature to one hundred and fifty or where the dyed rayons are to be used as warp in fancy sateen and twill weaves it is absolutely necessary to have level dyed shades. To do this the preparation for dyeing plays a very important part, particularly is this true in machine dyeing. The machines must be loaded uniformly, of the right tension, and the right quantity for each tier. The r. p. m. of the machine also plays a big part in the quality of the dyed product. For slow exhausting and level dyeing colors the r. p. m. should be low. This causes less agitation of the fibers, therefore, less breaking of the filaments, which in the finished product are known as "shiners". In the case of basic or vat colors which seem to be the most difficult for levelness it is best to have a higher r. p. m. to insure more turnovers per minute as this class of dyes exhaust very rapidly.

The dyeing of rayons today by machine is fast supplanting the older hand method on tubs or hand boxes. Not only is the quality of the dyed product much improved but the production is more than doubled. The dyeing cost is materially lessened, which economically speaking, is a big factor in this day of keen competition. Perfectly dyed rayon is now produced on skein dyeing machines in regard to penetration, levelness of shade, and brilliance of color. Better winding qualities are produced due to the exactness of the machines and the automatic turning of the skeins in union. The tie bands (as you may note in samples) are kept in place thereby causing less pulling and breaking of filaments. The actual dyeing of the rayon after the first batch, we might say, becomes a mechanical operation.

The scouring or wetting out of the artificial silk is important in the case of light shades but in the case of dark reds, blues and blacks it is not necessary thereby cutting out one operation. The highly absorbent powers of the rayon gives thorough penetration the first two or three minutes in the dye bath. The least possible handling of the wet fibers the better the winding and subsequent operations. In the event that scouring is done thirty minutes at one hundred and fifty with a good soap or oil should be sufficient. The dyer not only must be careful in selecting his dyes but he must be careful in selecting his assistants. This is necessary to give proper lubrication to the rayon and penetration to the dyes. This assistant must in no way form a precipitate in the dye bath either with the dyes or impurities of the water. Precipitates of this nature are one of the main causes of dullness of luster and shades. It is important to use as pure water as possible to prevent any precipitation from this source. If these substances become attached to the rayon it not only causes delustering but will give spotty and stained rayon after drying due to the action of heat on the precipitate. Oftentimes the dyer is called on to deluster rayon in connection with dyeing. This may be done by treating

in a bath of .5 per cent to 1 per cent of barium chloride then precipitate this in a fresh bath with glauber salt. This produces a very fine precipitate of barium sulphate on the fiber which breaks up the refraction of light. There are times when delustering occurs when it is the least thing wanted. High temperatures or too severe treatment produces what is known as "blinding of silk." This is one of the chief faults found in the dyeing of acetate rayon at high temperatures. The outer surface of the rayon becomes fused, so to speak, causing a matt surface.

The dyer, after all the care and caution in choosing his dyes in regard to rate of exhaustion, fastness test and ability to dye various fibers, will often find cases of rayon from the same source that more or less resist certain dyes, particularly those of the substantive group. I find this particular characteristic to be caused from the finishing material used by the manufacturer, usually free fatty acids. Oleic acid on the rayon can readily be distinguished by its peculiar pungent odor. This fault can be overcome by the use of soda ash or ammonium hydroxide in the dye bath. Quite often the dyer has large quantities of second grade and R.O.M. rayon to dye. This, as everyone knows, is an inferior quality and the dyer may expect an increase in trouble in proportion to the quantity of this inferior yarn he handles. Chalky or milky rayons are often found in this type of yarns. Doctor Shulky in a statement says that these imperfections are usually found to be sulphur precipitates that have not been properly removed in desulphurization. Dyes will not produce the same shade on these milky spots as on first grade rayon. Therefore, the dyer must overcome this fault if possible. He can some times but not in every case remove this milky condition by giving a pre-bath of hot sodium bisulphite for twenty to thirty minutes. This, of course, must be removed before dyeing as tendering is liable to occur.

In the dyeing of direct colors the dye bath may be started cold. In fact, for very light shades of tan, grey and rose it is best to not exceed one hundred and twenty-five degrees in a two to four per cent soap bath for the entire dyeing period. This will give level shades whereas at a higher temperature streakiness would occur. For the dyeing of heavy shades temperatures of 150 to 160 will give very level dyed shades with a much better exhaustion of the dye bath. The dyeing may be completed at this temperature with the addition of either common or Glauber salt. For best results the amount of salt, with the exception of black, should not exceed ten per cent. Heavier percentages must be given extra washings to get rid of this salt to prevent crystallization on the fiber. Charles L. Eddy, in a paper read at the meeting of dyers, bleachers and finishers does not advocate a dyeing temperature over 130° F. Experiments show that the dyeing period can be shortened by higher temperatures of not over 150, and less processing is an item to always be reckoned with in the handling of rayon. No noticeable difference in the luster is found in the two temperatures given.

The dyeing of basics on a machine presents another problem. It is very difficult to produce level dyeing without the use of a mordant even for light shades. The topping of directs or sulphurs for bright shades are not very successful due to the rapid exhaustion even in the presence of retarding agents. The winding of rayons that have been dyed with mordanted basics usually cause trouble. The yarn is harsh and in a more tangled state caused by the extra processing in the application of the mordant, which is a rather long operation for any fiber that is affected by water and chemicals as much so as the rayons. If mordanted, tannin-tartar emetic or the commercially prepared katanols are best. Three to four per cent tannin in a bath of 140° F. for thirty to forty-five minutes, fixed cold with one to two per cent of tartar emetic for thirty minutes usually gives good results. There may be those who prefer the one bath process of the katanols. This is done with four to six per cent, depending on the depth of shade, with the addition of fifty per cent salt to help exhaust the bath. This is applied at 140 to 160 for one hour, afterwards giving an acid rinse. After mordanting, the basics are dyed either in acetic or formic acid bath or contrary to most beliefs, in a soap bath, using from five to ten per cent soap. The dyeing is done at 120 with the dye being added in two or more portions of ten minutes each and continued thirty minutes after the last portion.

After dyeing comes another very important, yet often neglected, operation—namely, the process of drying. To the average mill man drying may mean just getting rid of excess moisture but to the skilled rayon dyer it is a science to be cultivated—a means for him to ruin or add to the beauty of a successful dyeing. Practically all dyestuffs are altered by excessive heat or prolonged drying. This is most noticed by increasing density of shades or off tone colors. Either one may mean the refusal of a match that was acceptable at the dye machine. Redyes, altho sometimes unavoidable, are not an asset to any dye house. The reaction of dyes to drying must be watched carefully by the dyer so that he may make necessary variations in his matching. I attribute the darkening of rayon colors in the dryer to the physical change in the rayon, such as the contraction of the diameter of the filament. Not only must the dyer have the temperature of the dryer under his control for the sake of color but must leave the physical properties of the rayon unchanged. Too high temperatures produced what is called case hardening or a wire like feel to the fiber that will not give a soft or flexible surface to the finished product. I consider a temperature of 160 over a period of eight hours

with a downward current of hot air sufficient to dry any rayon. Care must be taken that the air current is not too strong to cause tangling of the skeins. After drying the rayon should be conditioned sufficiently long to allow for proper regain which in rayon is about eleven per cent. The proper amount of moisture helps restore the luster and brightness of color to the fiber as well as give better winding and finishing qualities. Inspection of course must be thorough to separate out any streaky or damaged skeins.

In conclusion I would like to make a rather general statement. The preparation before and after dyeing is the secret to successfully dyed rayon.

The Chairman: I am sure we have all enjoyed this paper by Mr. Gryder. Not often do we get a paper that deals so definitely and explicitly with the subject.

Are there any questions or any discussion of Mr. Gryder's paper?

If not, is there any discussion or any questions on Mr. Hunter's paper?

Questions for Discussion

The next number on the program is the bringing up for discussion of three questions which have been called to the attention of the secretary.

The first question is: "Describe a simple test for the solubility of sulphur dyestuffs for use in packages and beam dyeing machines."

Mr. Chase, could we hear from you on that?

Mr. H. M. Chase: Mr. Crist asked me to lead this discussion, and I understand that probably can be construed to mean to ask questions.

I understand that the usual test made by dyestuff companies is to make a solution of the sulphur dyestuff and filter it through what is known as a Buchner funnel, which as you know is a flat funnel with a perforated bottom through which the solution may be drawn by connecting the funnel with a simple suction pump. The time in which a certain volume is carried through the filter paper is supposed to indicate the facility with which the dyestuff would penetrate a beam; also the amount of sediment left is an indication of the purity of the dyestuff.

I do not think, however, that this entirely answers the requirements. Possibly slight variations which would be unnoticeable on the filter are magnified on the large scale sufficiently to affect the results. Personally, I do not know any test which will decide positively in the laboratory whether or not a sulphur dyestuff will be satisfactory for dyeing beams.

Before making a practical dyeing any sulphur dyestuff should be thoroughly tested in the laboratory not only by the filtration test just mentioned but also by a series of dyeings which will show the amount of sodium sulphide required, the best temperature, amount of salt to be used and especially the tendency to exhaust rapidly or slowly.

This information together with possibly some previous experience with the dyestuff should enable the dyer to form a fairly accurate opinion of its suitability for beam dyeing and to make a practical dyeing or advise against it.

As everyone knows the success of beam dyeing depends entirely upon circulation and this in turn depends upon the density of the beam and the viscosity of the dye solution. As a rule hot solutions circulate more easily than cold ones, just as hot water circulates much more readily than cold water. Strongly alkaline solutions retard the circulation materially.

Familiarity with the various dyestuffs used is the safest guide at present, but an infallible laboratory test would unquestionably be very desirable.

I have said all I know about it. I think there are some dyers here who have had a great deal of experience with beam dyeing. I would suggest that Mr. Copeland give us his experience.

Mr. Copeland: I am not very familiar with sulphur colors. I have had quite a bit of practice on beam dyeing but nothing to amount to anything on sulphur colors.

Mr. R. W. Glenn: I would like for Mr. Chase to say something in regard to temperatures used in his beam dyeing or his stock dyeing with sulphur colors, particularly sulphur blues.

Mr. Chase: I am not an expert on the use of sulphur blues for beam dyeing.

On raw stock I can say that with most of the reddish toned blues you get a much brighter and fuller shade if you do not raise the temperature too high. On the other hand, a temperature of 180 degrees F gives a result which is faster to washing than a temperature of say 120 degrees F. A very good compromise temperature is 160 degrees F.

Mr. Lancaster I think has had a good deal of experience with beam dyeing.

Mr. Lancaster: I have not had much to do with dyeing sulphur colors on beams. I have had some on packages.

The Chairman: Mr. Foust, what is your experience?

Mr. Harold Foust: I have had no experience other than in the laboratory. I have had quite a bit of laboratory experience in Franklin machines but no actual dyehouse experience.

Mr. Pickup: I would like to ask a question of Mr. Chase. I am wondering if in your test of the Buchner funnel, in which you likely used pure filters of cellulose, if you could substitute a bleached cotton which would be nearer the character of the yarn being dyed?

Mr. Chase: I think that is an excellent suggestion. A piece of well scoured absorbent cotton cloth would undoubtedly make a better filtering medium. There are two kinds of impurities. If the filter paper or piece of cloth collects a slimy sediment that color is not likely to circulate freely. On the other hand it may collect some dry chaffy

pieces that do not stop up the pores and which will not affect the circulation. The dry dirt in a dyestuff does not give nearly as much trouble as a slimy sediment. The latter tends to clog the beam and then the pressure goes up, the circulation slows down and the beam dyes heavy on the outside and inside and light on the middle zone. Sometimes you cannot see the slime, yet one dye solution will apparently be more of a viscous nature than another. One will be slick and the other will be sharp. The one that is sharp like water will go through the beam more easily. A solution that tends to be gluey in the slightest degree is apt not to dye well.

That is about as good an illustration as I can give although you can actually use glue and it goes through very well, so that sounds a little inconsistent. As I say, I do not know personally of any way of demonstrating except to try it.

Of course there is one thing that should be tried on a sulphur dyestuff before you do anything with it and that is the amount of sodium sulphide required and the ease with which it dissolves. If you do not get it into a thorough solution, then you will have sediment of undissolved dyestuff which will clog. In the case of some browns we even put them in a barrel with the proper amount of sodium sulphide and a bag over the top of the barrel and turn the steam on wide; after once going into solution they give no trouble.

The Chairman: I would like to ask if you have any theory as to whether it is a chemical or a physical question; in other words would the question of the surface tension have anything to do with it?

Mr. Chase: I think in so far as it is connected with the viscosity of the fluid it would undoubtedly have effect. We do not do so much sulphur work in beams except in blacks but the viscosity of the solution of course has a great deal to do with its success as a dyeing medium, and it is quite possible that a viscosity test could be arranged, and would be of value, because it is certainly true that if one fluid has a greater viscosity than another, it will not pass through a beam so well. Too much caustic soda or too low a temperature will materially affect the circulation.

The Chairman: I am going to suggest to Prof. Grimshaw that this is a subject which at some time might be worthy of study in his laboratory. It would be a contribution to the industry, because it seems to be a point which is unsettled.

Any further discussion?

Mr. Thompson: I would like to ask Mr. Chase whether he thinks the use of pure sodium sulphide having a Na_2S content of nearly 100% instead of 60% would help solve the problem we are discussing. Unfortunately it costs more than the 60% and our purchasing agents do not always see the wisdom of using it, but do you not think that it would help?

Mr. Chase: In very light shades it might. The impurities in sodium sulphide do not seem to be of a viscous nature, however, but are like dry dirt and settle on the outside of the beam and do not seem to have any particular effect on the circulation. With impure sulphide you will sometimes have beams with quite a little dirt on the outside, but it will be dry dirt. When the dyestuff is not in perfect solution a noticeably viscous sediment will collect on the surface of the beam and this obviously interferes with the circulation.

The Chairman: Whoever asked that question apparently started something. I hope at some future meeting we can get a little more information on it.

That really, as I see it, should be the chief function of our meetings, to bring up these unsettled questions and try to obtain mutual help through these suggestions and discussions.

The next question is: "What difference in results can be expected and how do costs compare when using the following chemicals for souring agents after bleaching cotton goods with chlorine, sulphuric acid, oil or vitriol, bisulphite of soda, hypo and sulphur dioxide?"

The Chairman: What differences in results can be expected and how do costs compare when using the following chemicals for "souring" agents after bleaching cotton goods with chlorine, sulphuric acid, oil of vitriol, bisulphite of soda, "hypo" and sulphur dioxide?

Is there any discussion on that?

I believe that so far as souring agent on cotton goods after they had been treated with chlorine, we can almost eliminate hypo. Does any one know or use hypo as a discoloring agent?

Mr. Chase: What do you mean by hypo?

Mr. Thompson: By hypo is meant thiosulphate ($Na_2S_2O_3$).

Mr. Chase: That would be altogether too expensive.

The Chairman: The Chairman is going to take it on himself to eliminate that. Then we come to sulphuric acid, and under that we could take any acid.

Sulphuric acid and sulphur dioxide. Is there anything to say on that?

Mr. Thompson: The reason oil of vitriol was put in the question with sulphuric acid, on one occasion I was in a bleachery and asked the man for sulphuric acid, and he went to the other room and came back and said, "We have no sulphuric acid but we have oil of vitriol."

However, there is no argument that sulphuric acid will drive out the chlorine left in the goods after bleaching with hypo chlorite but it does not neutralize the chlorine or the hypochlorous acid. The bisulphite and sulphur dioxide have the effect of neutralizing the chlorine reducing its valence to negative form.

The question of whether sulphur dioxide or bisulphite of soda or hypo would be used would depend on the rela-

tive cost of each one of those products. After all, the sulphur dioxide is what does the actual work. Now, if you can buy sulphur dioxide in cylinders and pay freight back cheaper than you can buy the bisulphite of soda, figuring it contains a certain per cent of SO_2 which it does, as does hypo, but which costs a little more on the present market, depending on that question, the use of those three products should be decided.

As far as convenience is concerned, many think it is more convenient to use sulphur dioxide, while others prefer bisulphite of soda. Some folks think it is not necessary to wash sulphur dioxide out of goods after bleaching. I think our treasurer has some remarks to make on that.

Mr. Geo. P. Feindel: In the use of sulphur dioxide on light fabrics, it is not essential to wash out SO_2. On heavy fabrics it is very essential. When I speak of heavy fabrics I have reference to ducks and twills. I think they can be given a good wash and not leave any trace of SO_2 in the fabric.

The Chairman: Have you ever tried to detect the presence of SO_2 in goods which have not been washed after being dried?

Mr. Feindel: I have taken heavy goods that have not been washed after SO_2 treatment, water mangled them and dried them on dry cans and right away you can get a trace of sulphuric acid with congo red paper, which leads me to believe that the SO_2, through oxidation, forms a weak solution of sulphuric acid.

Mr. Pickup: I have not had much experience with sulphur dioxide but I find that sulphur dioxide gives the cloth a kind of dead look and sulphuric acid, which is most commonly used, but if you just want to neutralize the chlorine, I believe muriatic acid is better than any of them.

Mr. Paul F. Haddock: Most bleachers determine what "Sour" to use not by the comparative cost of sulphuric of sulfurous acid but by the condition of their goods after boiling and chemicking. Bleachers using the two-boil process invariably use sulfurous acid as a final anti-chlor, and that is all they need. Bleachers using the single-boil process are very partial to the use of sulphuric acid. Why? Simply because single boiled goods frequently contain kier stains and sulphuric acid helps to kill kier stains, neutralizes the chlorine and brightens up the goods, while sulfurous acid is merely an anti-chlor.

The Chairman: I think Mr. Haddock made a good point. I agree with him in that the use of any acid has an advantage over the use of SO_2 in any form, in that it does not tend to remove kier stains. However, a good many plants sour the goods and then give them a chlorine bath afterwards.

Mr. Pickup: I find in taking sulphuric acid, to neutralize chlorine it will take the chlorine out but muriatic acid kills the chlorine almost instantly.

Mr. Feindel: I have never used muriatic acid for an Anti Chlor after bleaching, but I think the difference is due to the fact that sulphuric acid forms in soluble compounds and muriatic acid forms soluble compounds. I think all of us are doing wrong in a way by using sulphuric. I believe the ideal acid is muriatic acid, as it more readily removes traces of iron from bleached material.

The Chairman: How about the cost?

Mr. Feindel: If you consider cost before quality, that is up to yourselves.

Mr. Thompson: I have noticed that several of the bleacheries, where they have a good deal of iron, use a mixture of 50-50 of sulphuric and muriatic acid with good results.

Mr. Feindel: Can they use the same equipment for muriatic as they now have on sulphuric?

Mr. Thompson: The solutions are never over one degree and most use wooden pits.

Mr. Feindel: How about if you have lead pipes? Is it necessary to change them?

Mr. Thompson: It would not be practical to use lead. I think you can get some of these especially prepared iron pipes—Durion.

Mr. Pickup: Muriatic will eat Durion right up. It is all right on sulphuric acid.

Mr. Puckett: I think there is one aspect we have to consider in choosing a souring medium and that is whether the goods contain color effects or not. I think you will find where the goods have color effects that SO_2 is safer. If the chlorine is not thoroughly washed out and you use a strong acid like sulphuric you are liable to get what is known as a "buck" sour. Certain colors are most susceptible than others. You have to be very careful in washing the chlorine from your goods before using ony of the strong mineral acids, else some of the colors will lose quite a lot in depth.

Mr. Feindel: Is there such a thing as a neutral sodium bisulphite?

Mr. Thompson: I do not think there could be.

Mr. Feindel: Certain salesmen say they have a neutral sodium bisulphite.

Mr. Thompson: Sodium thio sulphate would be more nearly neutral than bisulphite.

Mr. Cobb: I find in using bisulphite on nap goods it won't nap. Is it me, or is it something the matter with the goods? It will not nap as well as using sulphuric acid.

Mr. Thompson: I do not think bisulphite in itself is the cause of the trouble. It may possibly be caused in not washing it thoroughly.

The Chairman: Any further discussion of No. 2. If not, we will pass on to No. 3.

The question is: "Can Naphthol Red be successfully dyed on raw stock?"

Mr. Newman, we would like to hear from you.

Mr. Newman: The question as asked is a little vague. In the first place I presume that whoever asked this question is referring to cotton raw stock as I do not believe anyone would be interested in dyeing wool stock with Naphthol Red. Then when it comes to the term "Successfully dyed," there is always a little misunderstanding between demonstrators and mill men whether something has been dyed successfully or not.

So far as I can see, there is no difficulty in actually dyeing cotton raw stock with Naphthol Red. The trouble begins when you try to use the cotton which has been dyed. In other words considerable difficulty is experienced in the carding, drawing and spinning operations.

It occurs to me that there are two minor elements and one major element that enter into the dyeing of the Naphthol colors that have a bad influence on the succeeding steps in the manufacture of cotton goods from the raw state. First is the fact that a considerable amount of soluble oil was originally used in the Naphthol bath and until the last few years it was considered necessary. All of you are familiar with the fact that soluble oil in any quantity has the effect of making cotton raw stock rather gummy or sticky. However, since prohibition, alcohol has been found to be a very satisfactory substitute for soluble oil in Naphthol dyeing and this would overcome the above mentioned objection.

The second minor element is the fact that a considerable quantity of caustic soda is used to effect solution of the naphthol and to keep the naphthol bath in solution during the process. As all of you know, caustic soda in noticeable quantities generally has the tendency to shrink the raw cotton; however, even larger quantities of caustic soda have been used in dyeing vat colors than are necessary in the use of Naphthol colors. By a thorough washing the vat dyed cotton has been handled in a successful manner.

So it looks as though the first two objections can possibly be overcome but the third and by far the most important element that may cause trouble is the type of color produced by the Naphthol series. All of you know that, when you impregnate cotton with naphthol and then couple with a diazotized base or fast color salt, you are really forming an insoluble, organic color lake or pigment on the fiber. When cotton has been impregnated with naphthol the fiber is super-saturated and, unless by drying you drive in that surface naphthol, a considerable amount of surface pigment or color lake will be formed when the naphthol is coupled.

On cotton yarns and piece goods, it is possible to eliminate the majority of the surface pigment by a thorough soaping but as all of you know, if you soaped raw cotton you would then have another element to contend with in the ordinary spinning operations; although, I understand there is a certain spinning process by which raw cotton may be used successfully in spite of the fact that it has received a thorough soaping. Since this is out of the ordinary though, I do not believe it would be of particular interest in this case.

However, in addition to the surface pigment or color lake, when you dye cotton raw stock with Naphthol Red, you are going to have cotton fibers that are filled or loaded with an organic pigment and it is that problem which is giving the trouble, since it is difficult to card and spin a fiber so heavily loaded with such pigment. It is just the same as though you tried to card and spin a cotton fiber which has been heavily loaded with a clinging, rather tenacious foreign compound.

In these days and times of the radio, talking movies, television, etc., I am certainly not going to go on record as saying that any dyeing problem or in fact anything else is impossible, but so far as I know Naphthol Red has never been dyed on a regular production basis on cotton raw stock in such a manner that it can be carded, drawn and spun successfully but that is by no means saying that it cannot be done.

Mr. Copeland: I would like to ask Mr. Newman a question. If you could dye Naphthol in the roving on a package, would it be practical to spin it?

Mr. Newman: As to that I cannot say definitely. In addition to the fact that the fibers would still be filled with pigment, there would be some of this color left on the surface which might cause a considerable amount of red dust throughout the spinning room.

The Chairman: Is there any further discussion of this question of Naphthol Red?

If not, the chairman will once more go off the air and turn the meeting over to the secretary, Mr. Thompson.

Mr. Thompson: We have a beautiful thing here tonight, combination of pen, pencil and do-hickey to put on your golf paraphernalia when you go out. This is going to the man lucky enough to have his card drawn from those that were returned before yesterday.

But before we have the drawing, there were seven or eight cards sent in making reservations and as I look through the audience I do not see the fellows here tonight, and if you will permit me to go into the matter of finance, it is costing the Section approximately $50.00 deficit on the meeting, and the object of the cards and the object of the little gift is to encourage you boys to send in your reservations so we will know how many to prepare for and to guarantee the hotel. So for your sakes please send in your cards, and if you cannot come, please send in your check at least to cover your reservation.

Upon drawing for the prize, the card of W. R. Ivey, Greenville, S. C., was drawn and the prize awarded to him.

The Chairman: Before we close I am going to ask for a rising vote of thanks to Mr. Hill Hunter, of the Proximity

Mills, Greensboro, Mr. D. O. Gryder of the Southern Dyeing Company, Burlington, and Rev. A. B. Conrad of High Point, as well as the members of the local committee, Messrs. R. M. Mitchell, R. W. Glenn and J. D. Sandridge, who have really done the work.

Upon motion duly seconded and carried, the meeting adjourned.

Respectfully submitted,
A. R. Thompson, Jr., *Secretary*

New Kinks in Wool Dyeing

By Werner von Bergen

IN no department of dyeing is the changing from work by hand to machine-labor so slow as the dyeing of loose wool. Most of the responsibility for this condition is not so much the fault of the machine builder, as it is the fault of we chemists and dyers.

Persons engaged in this line of work, who at this present day still permit the dyeing of wool in open vessels, overlook a considerable amount of waste of steam and chemicals. They are to be compared with an old farmer who goes to New York in a rickety old horse and buggy and expects it to keep up in speed with the automobile.

It is ignorance, fear of difficulties, indifference, and an unhealthy conservatism, which hinders natural developments. And yet, the figuring of the cost is so clear and simple and so much to the advantage of the manufacturer that it is really astounding that such working methods are still employed in this age of rationalization.

The largest quantity which can be dyed properly, that is normally, in an open vessel is about 120 lbs. and for this dyeing, two men are necessary. Whereas; the machines can be loaded with over 600 lbs. and only one man is necessary for tending two such machines. The volume of liquor in proportion to the goods is 50 to 75 per cent smaller in the machine; the amount of chemicals can be reduced and the steam cost is 50 to 75 per cent lower.

Entirely aside from the question of labor and steam saving, valuable advantages are secured for the further manufacturing processes, through the fullest preservation of the wool fiber which retains its suppleness and soft handle thereby. The felting of loose wool is prevented. This fact likewise insures a smoother working and longer material in carding and a better yarn in spinning.

Most of the adherents to the old open kettle system take for their argument the fact that the dyeing in an open kettle is more even than any machine dyeing. This assertion is not infallible. The explanation is that during the working through with poles or hooks, the uneven appearance, that is, dark and light spots, are separated and mixed again. The finished dyeing looks even, but upon closer inspection shows up as a mixture.

In the machine where the material remains immovable and the liquor circulates, the unevenness can be seen much easier as light and dark patches lying next to each other. As is often the case with beginners, bad dyeing results look miserable.

Causes for dye-troubles may be found in the following places:

1. The method of dyeing—not following directions.
2. The dyestuffs, chemicals, or water.
3. The dyeing-apparatus, unsuitable metals, poor pumping circulation, leaks.
4. The wool, poor scouring, bleaching, carbonizing, or strongly affected by sun and weather.

Regarding all these points, the dyer must collect the necessary experience in order to master the machine dyeing right. However, he will never be through learning as new problems are constantly arising.

The shortness of the time does not permit me to go into all the details of machine dyeing, and besides, there is not much you are not already acquainted with. All the most important data can be found in many of the excellent little books put out by the various dyestuff manufacturers.

I should like to add only a few little things and describe to you some interesting cases of my own experience.

In order to get the highest fastness properties for loose wool, principally chrome or vat colors are used. For lesser requirements Neolan or Palatine colors and some neutral and acid colors are employed.

Chrome Colors

In one of the books already mentioned, the directions for the methods of dyeing were laid down as follows:

"The methods of dyeing in machines are generally the same as when dyeing in open vessels. It must, however, be borne in mind that just in machine dyeing, excepting the case of black or deep shades, the subsequent addition of acid has no favorable effect, and that it is more advantageous to add the whole of the acid required for exhausting the bath right at the start, and to prevent the dyestuffs from rushing on the fiber by heating more gradually. In such cases, it must be remembered that by working with a smaller volume of liquor, less acid is required than when dyeing in open vessels, with the result that most of the fast-to-milling Acid and Chrome colors may be completely absorbed already by the addition of 5-6 per cent Acetic acid."

The correct exhausting of the dye bath is one of the most important points in the dyeing of chrome colors. And here it is that most mistakes are made and the uneven dyeings result.

The dyer should know from all his various recipes the necessary acid amount for the exhausting of the bath; in fact, the acid content should be so high that when the

Presented at the January Meeting of the New York Section

bath is heated within one hour and after an approximate boiling of 20 min. the bath has to be regularly exhausted.

The ascertaining of the exhausting is a simple matter which every dyer knows but very seldom uses. In periods of 10 minutes each, liquor samples are taken out of the bath with a test tube. The test tubes are put in a rack next to each other. Thus, exhausting can be followed very exactly by the gradual lightening of the liquor.

In a very short time the dyer will discover the following facts:

1. The various exhausting properties of the dyestuffs. We have dyestuffs which exhaust at 90-120°F. and others which do not begin until a temperature of 160°F. is reached.
2. That the necessary amount of acid cannot be figured simply on the quantity of wool, but that it is more or less dependent on the amount of dye liquor. For example, for a dyeing of 400 lbs. of wool, 20 lbs. of 5 per cent Acetic acid are necessary, so when I dye only a quantity of 300 pounds, the same amount of acid is needed, that is, about 7 per cent. Therefore we get the best results with a definite acid concentration.

The accurate testing of this concentration is possible today for each dyer by employing the simple colorimetric method of pH number determination.

Only dyestuffs of good solubility can be used for machine dyeing, as insoluble particles of dyestuffs give rise to serious trouble. They remain on the material and can smear in spinning or surely bleed later in the washing and fulling of the goods. For this reason every dyestuff must be tested for its solubility. The following quantitative method always gave me a clear picture.

0.2 gr. dyestuff are boiled for one minute with 50cc. distilled water and then filtered through a weighted filter. The sediment on the filter is then rewashed with 50cc. boiled water, then dried and weighed. The insoluble residues should be less than 0.5 per cent.

Dyestuffs which can only be dissolved with the help of ammonia should not be considered at all, as 100 per cent dyeing are never obtained.

Water:

The water must be pure and as soft as possible. The best results are obtained with condensed or soft water. When hard water has to be used, the hardness should not be higher than 12 grains per U. S. gal. But, for some of the most used blacks like Eriochrome Black T, only a water of very low hardness can be used as it precipitates very easily in hard waters.

Defective Apparatus:

The most trouble caused by defective apparatus may be traced back to the presence of unsuitable metals.

Iron in particular is unsuitable for wool dyeing since it strongly affects the tone and the fastness of practically all the dyestuffs. For this reason iron pipes and iron pumps should not be used. The vat colors form an exception as they can be dyed in iron vessels.

Chrome dyeings which were produced in iron-containing apparatus sometimes lose through the washing and fulling process, 20 to 30 per cent of their depth. Also copper has an unfavorable effect on some dyestuffs. Monel-metal and Nickeline are better, but not satisfactory enough for building whole dye vessels. In some of the stainless steels it seems that finally materials have been found which will meet the highest requirements. But the experience of the practice is insufficient at this time to give a conclusive and final judgment.

To test a metal regarding its usability in the wool dyeing trade, especially for chrome colors, the simplest way is to put a little piece of the metal in the dyebath with a very sensitive dyestuff. Eriochrome Verson is especially suitable for this purpose. The normal color of this dyestuff is green. With Monel-metal it is green-grey: with copper and nickel, it is blue; with iron, reddish-grey.

Vat Colors

The start with the reduction of the dyestuff and the maintaining of a healthy vat during the whole process plays an important part. The recipes and descriptions given out by the Gen. Dye Corp. for their Helindone colors are quite accurate for open vats and I do not question their accuracy concerning the special vat-dyeing apparatus; but I found that in other machines like the regular Obermaier wool-dyeing apparatus, the hydrosulphite and ammonia quantities have to be doubled otherwise in the middle of the process the dyestuff will fall out. The strong pumping circulation on the surface of the vat brings the liquid too much in contact with the oxygen in the air.

The best results are obtained with a pH number of 9.2-9.4 of the bath. A too high alkali content leads to a color whose fastness to fulling is very poor, besides the alkali damage to the wool.

The present vat dyestuffs, which are in reduced form on the market, have the disadvantage that they get partly insoluble when stored for a long period of time and often lose up to 50 per cent of their strength.

For this reason, it is the duty of the dyer to test the dyestuffs before using them. In times such as these, when there is little work, it is better to keep the un-reduced powder colors in stock.

The usual trouble for which the wool is to blame is that the dyeings are very apt to be white-tipped, with certain vat colors, especially with Indigo-Helindone Blue R or B. Under this phenomenon, the dyers understand the much lighter coloring of the staple ends. The cause of this appearance, I have made clear in different publications;* the wool ends are already chemically changed by the sun-light while on the back of the sheep. This

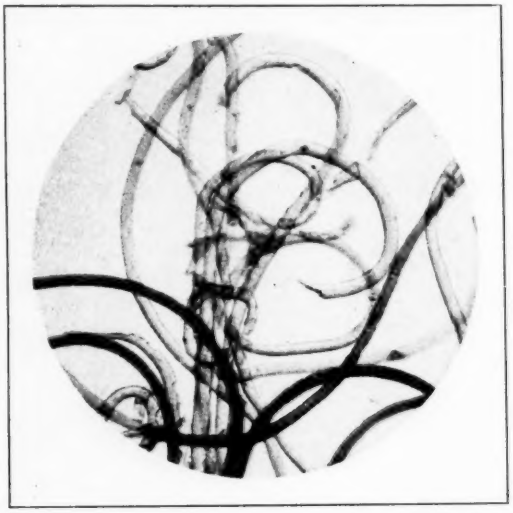

Fig. 1

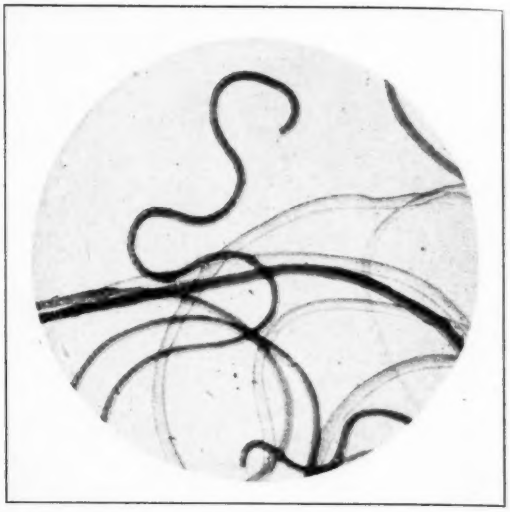

Fig. 2

In Fig. 1 we see such a white end from a regular Indigo dyeing. All the lighter fibers were affected by the sun; through the alkali in the scouring and the vat, the fibers were swollen, the scales dissolved, and even parts of the cortical layer destroyed. The curling effect is caused by the uneven exposure.

The Fig. 2 shows the dark colored ends resulting from a chrome dyeing with a positive dyestuff.

Fig. 3 shows a few fibers from the ends of an Australian wool staple taken from the back of the fleece. They give no evidence of any damage.

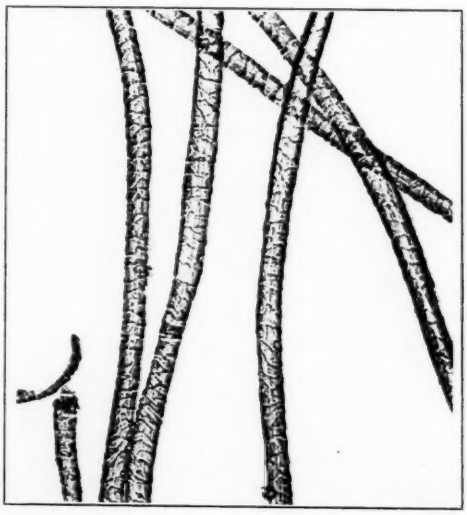

Fig. 3

Fig. 4 shows fibers from Fig. 3 after they had been treated with N/10 Caustic Soda. The width of the hair has doubled, the scales have partly disappeared and distinct longitudinal striations are visible.

In Fig. 5 fibers of Virginia wool are shown taken from the back of the fleece. The fibers are without their scales and the longitudinal striations are clearly visible. The rain in connection with the Potassium-containing suint has dissolved parts of the Keratine which has been chemically changed by the influence of the sun.

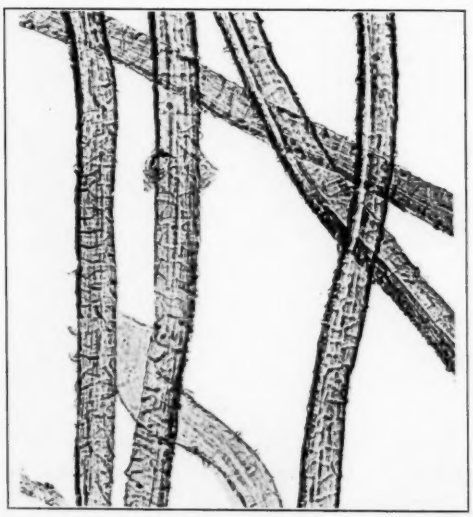

Fig. 4

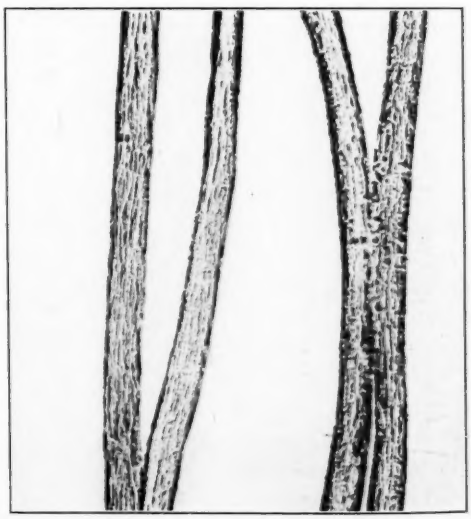

Fig. 5

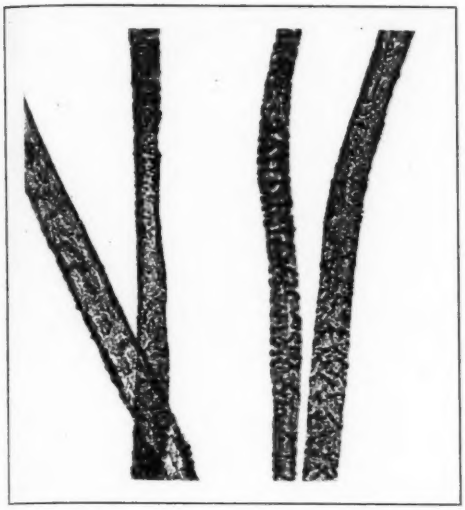

Fig. 6

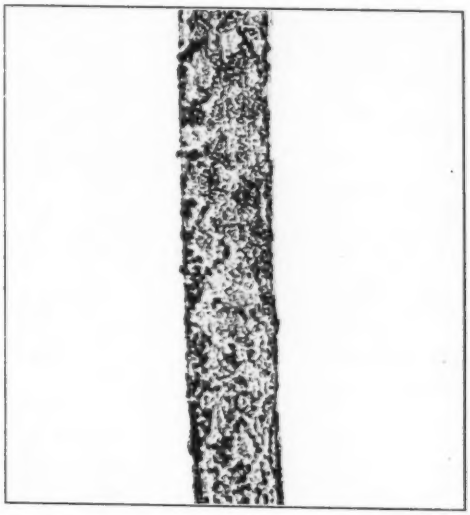

Fig. 7

Fig. 6 shows 4 wool fibers covered with Titanium oxide particles.

Fig. 7 shows a single fiber 360X enlarged covered with Titanium oxide.

Fig. 8 shows 4 fibers from a printed woolen cloth. The fibers are partly damaged which can be seen from the deep striations and cracks and from the scales which are only very slightly visible in some places.

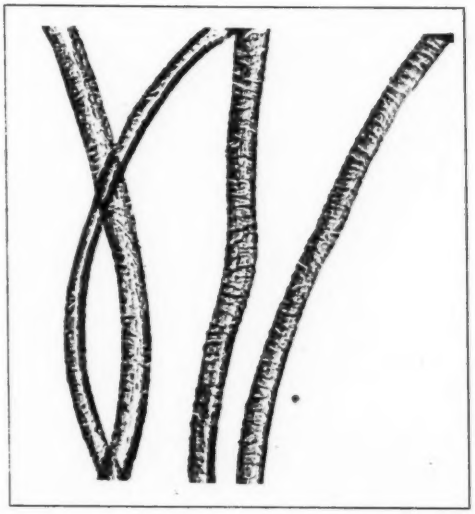

Fig. 8

In Fig. 9 we see the same fibers after treatment with caustic soda. They show a swelling of over 100%.

Fig. 10 shows fibers from the same specimen as Fig. 9 with two especially interesting fibers. One fiber shows an unusual expansion of over 200%. Through the middle, as fiber with strongly constricted parts. Such constricted fibers are characteristic of chlorinated wools.

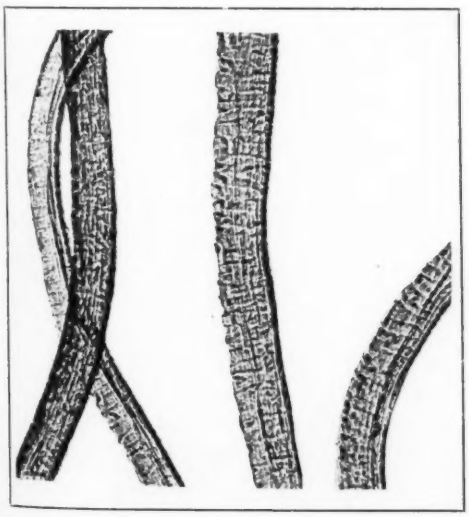

Fig. 9

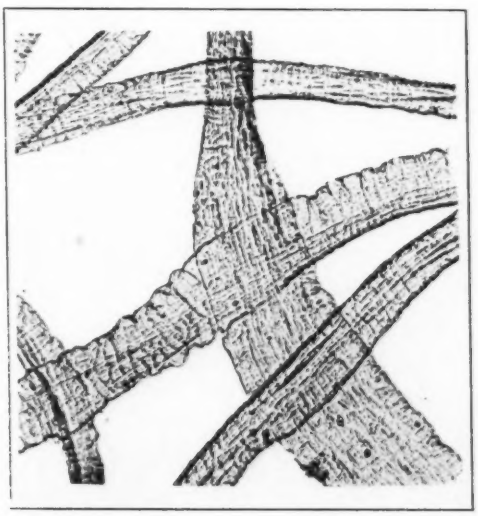

Fig. 10

makes itself apparent through the different affinities for dyestuffs.

In the sample book, I.G. 63 (page 17) regarding Helindone colors, we find the following explanation of this phenomenon:

"When the vat contains too much hydrosulphite, and when the squeezer works badly, the dyeings are very apt to be white-tipped, as the liquor containing hydrosulphite runs together in the tips of the wool. There it again reduces or dissolves the dye already taken up by the fiber. Immediate spraying will in such cases prove effective.

This proof is not correct, as:

1. When dyeing with Indigosol, the ends show up the same way, although no hydrosulphite is present at all, and
2. With the Helindone colors which are derived from the Indirubine, the ends are dyed darker as can be seen from these samples.

There is only one sure way to overcome this trouble which gives the finished piece the appearance of a mixture, and that is to add to the negative Indigo, a positive dyestuff having a greater affinity for the ends.

Among the blue Helindone dyestuffs, only one can be used. That is Brom Indigo, and it alone dyes evenly. That means, no differences can be seen between the exposed and unexposed parts. Contrary to this, we have in Sulfoncyanine a weak acid dyestuff which under certain conditions strongly dyes the ends. For this reason, it is excellent to make a completely even dyeing.

I have here two samples from a practical test of the above method I worked out years ago.

Neolan and Palatine Colors

In this new group of dyestuffs, as they have included the necessary amount of chrome in the molecules, the concentration of the acid plays an important part.

The instructions of the dyestuff concern in regard to the acid are as follows:

6-8 per cent Sulphuric Acid—66° Baumé

I found that with the concentration of 2 gr. Sulphuric Acid per liter corresponding to the pH number of 2.2 to 2.3, the most even and deepest dyeings were obtained.

I came across one especially interesting case. In the dyeing of a yellow-green with Neolan Green B and Neolan Yellow GR, we got a dull olive green instead of a lively yellow green from the machine. The dyeing with Neolan Green alone resulted in a very dull blue instead of the regular green.

The laboratory test showed that the Neolan Green B is very sensitive to tannic acid which changed the color to blue-green instead of the regular green shade. The Ciba as well as the Gen. Dye Corp. still owe me an answer for the phenomenon.

After the ignition of the dyestuff I found with the chrome, a small amount of iron. So I think the tannin-iron compound is the cause of the change of color. The peculiar thing was that only in newer machines (about two years old) do we get this change of the dyestuff; whereas in a 10 year old vessel (wood), the dyeing came out similar to the laboratory dyeing. Thus, I came to the conclusion that the tannic acid from the new wood was to blame for the trouble.

Let us look in another part of the dyehouse.

As stripping agents of dyed wool pieces, the wool dyers use mainly, alkalies, hydrosulphite, and titanium salts. From the alkalies, especially ammonia is used. It is in many instances especially suitable for the stripping of acid colors.

The stripping is done in a boiling bath with about 2cc. ammonia per liter. No noticeable damage is to be feared, as the boiling is not continued for a long time.

The fact that the titanium salts are still used today, where the Hydrosulphite is so much better, again indicates a certain amount of conservatism. The titanium salts have as their principal disadvantage the fact that titanium oxide, which has resulted from the reduction, attaches itself to the wool fiber and gives the goods a harsh feeling. This can be removed only by treatment with Sulphuric acid to dissolve the oxide.

In closing, I wish to include just a little addition to satisfy the wool printers present.

I take it that it is generally known that all wool material which is to be printed is chlorinated, this is to get the affinity for the dyestuffs. It would be very convenient for the printer to have a simple and quick method to test these pieces for the chlorination.

I will give you here such a simple microscopical-chemical method which is similar to the method I brought out for determination of the light affected wool. If the chlorinated wool is treated under the microscope with a few drops of N/10 caustic soda, it immediately swells up over 100 per cent. This reaction proves that chlorinated wool is very sensitive to all alkalies. And for this reason the using of such chemicals as ammonia should be abandoned for dissolving dyestuffs for printing pastes.

Especially in the following steaming process, the wool will be easily damaged and lose its strength. I have here a sample of such a case. On all places where the red color is, the wool is very weak and the reason for this probably is the using of ammonia in the make-up of the printing paste.

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*1. Die Wollspitzen und ihr Verhaltenin der Farberei, Melliand's Textilberichte, 1923. Pages 23, 79, 123.
2. Einfluss des Sonnenlichtes auf Wolle, Melliand's Textilberichte 1925, Page 745.
The Effect of Sunlight on Wool, Translation of I. Ginsburgh in the Textile Colorist 1926, Page 667.
3. The effect of Exposure in Wool Before Dyeing, The Melliand, 1929, Page 1084.
4. Method of Determining the Effect of Light Upon Wool, The Melliand, 1930, Pages 9, 186.

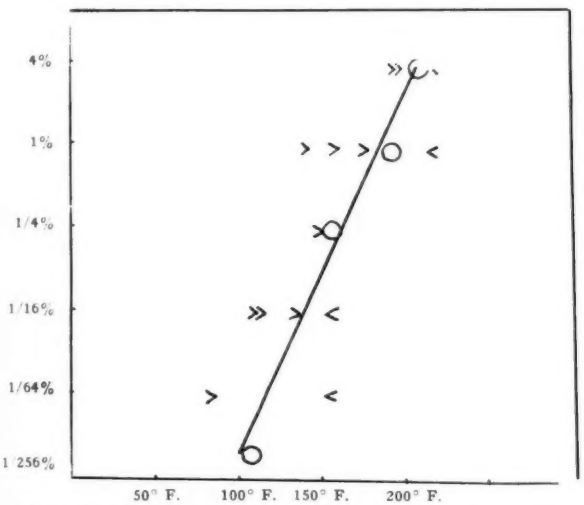
Proceedings of the American Association of Textile Chemists and Colorists

The Numerical Solubility of Dyes*

By W. C. Durfee

THE chart here presented shows the apparent solubility of commercial Hematine Extract in acidulated water, prepared to represent a dyebath with about one pound acetic acid per thousand pounds of water. In the laboratory that would be around 20 drops per liter, using in this case commercial acid of about 28 per cent strength.

From this chart it will be seen that the solubility of this dye changes about five hundredfold between 100° F. and the boil.



Solubility Hematine Extract IMP in Slightly Acidulated Water, Percentage by Weight

At a temperature of 150° F. where the liquor of a sour bath holds only ⅛ per cent of dye on the weight of liquor it must be clear to any dyer that only a very few per cent of dye based on the weight of the goods being dyed could be dissolved in the entire bath.

The writer has noticed in his work several dyes which show rapid changes of solubility and which become really soluble under practical conditions only at comparatively high temperatures.

In the present case the solubility is about 3 per cent at 200° based on weight of liquor used.

It is only 1/130 per cent at 100° F.

Some of the best dyes are in this class and are very little soluble in cold water.

Numerical figures of this sort have an application to practical purposes.

One of the outstanding features of some knowledge of numerical solubility is that a man can reckon on having a good acting dye bath above a certain temperature. He can reckon beforehand how to manage his work.

It seems to be generally true that a dye not really in solution will dye fairly well but in a most uncertain manner.

When it has just recently been put into cold water or cooled down after having been dissolved, it seems for a little while as if it were in solution. But its dyeing action keeps getting worse and worse and finally is very slow.

If dyeing must be done at low heats, it is well to know the numerical solubility so as to check up and find if the dye had a chance to be dissolved before being put in the cool bath. This permits the dye to be in a good regular condition at least at the starting moment, if the bath is regular.

The need of knowing numerical solubility applies also to machine dyeing where one frequently must calculate what to do. For example, one may calculate how much dye the machine could take at each temperature. In this way a machine may work which otherwise would not work unless supplied with poorer and more soluble dyes.

In order to get the necessary information about solubility the author has found it useful to prepare a chart in about the manner shown in the example.

This is effected by putting the numbers of the scale in a geometric series such as, 1—4—8—16 or some other like 1—4—16—64, or in fractions using the numbers in the denominator.

Without this precaution, the diagrams usually are difficult to read.

This can easily be learned by anyone who will plot the example shown against an ordinary arithmetical scale.

The diagram will run nearly flat and then nearly vertical.

There are various ways of judging dye solutions.

In preparing the present example, a number of samples of various strengths were slowly heated and cooled in glass vessels—and compared with each other.

In the stronger solutions, there was very little doubt about the solution being either cloudy or clear after standing a little time, and in a general way the amount out of solution could be estimated.

The arrows shown on the chart each indicate the appearance of some solution.

On the 1 per cent line are three arrows at 140°—160°—175° pointing to higher temperatures, and one arrow at 212° pointing to lower temperatures which mean that this solution was examined from time to time at these temperatures, and that it was quite clear at 212° and quite cloudy or lacking in clearness at 175°. There is also a circle showing that it was more carefully examined and the results charted.

There is also a circle at the bottom of the line which represents a sample of 1/160 per cent strength.

* Presented by title at the Annual Meeting.

It was noted that the color of the weak solutions faded when they cooled.

At about 100° F. they would get as pale as a hot solution of 1/160 per cent strength. It seemed fair to conclude that the color was mainly due to the amount which remained in solution at 100° F., especially as this agreed with the general tendency. At any rate, it should be possible to estimate the condition of a weak solution by its color as there seems good reason to expect this to gradually fade if not in solution.

The writer has not had occasion to measure the solubility of hematine except in the sour bath, as he had occasion to use it in a comparatively insoluble state by preference.

He presents the present paper because he thinks the methods described are fairly serviceable and because he would be glad to see numerical information accumulated by other members and published from time to time as an aid to the art.

MEETING OF NORTH CAROLINA STATE COLLEGE JUNIOR SECTION

THE North Carolina State College Junior Section of Textile Chemists and Colorists had as their guest, recently, at the Textile School, James W. Black of the Ciba Company. Mr. Black graduated from this school with the class of 1929 and is now a salesman for Ciba Company.

He gave a very interesting lecture to the members of the Junior and Senior classes who are specializing in Textile Chemistry and Dyeing. Since graduating from the Textile School he has been acquiring much practical knowledge in the dyeing industry and his lectures on "Color Matching in the Dye Manufacturer's Laboratory" followed by another lecture on "Application of Vat Dyes on Padding Machines" were received with much interest. He had various samples with him to show how satisfactorily these very fast dyes can be applied to piece goods by means of padding. His lecture was accompanied by drawings on the blackboard.

One of the classes was taken to the laboratory. Here Mr. Black demonstrated skein dyeing by use of Cibanone Blue R. This was practical work as the yarn is used in the weaving department of the Textile School. He showed the students some important points relative to temperature, dissolving and reducing of the dye.

The Junior Section was fortunate in having Mr. Black with them and feel that he and other practical men give valuable information in their talks and demonstrations.

Respectfully submitted,

D. B. HARDIN.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

A. P. HOWES, President — M. D. REESER, Secretary — H. F. CRAWFORD, Treasurer

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00

Vol. XX March 16, 1931 No. 5

ON SELECTING FOREMEN

A REAL executive is one who can get others to do their work properly. Therefore, it follows, that without the ability to unfailingly exercise good judgment in the selection of men, no one can obtain the fullest measure of commercial success. Without exception, the leaders of industry of all time have owed much of their position to the high value of their subordinates. In every case the ability to recognize, obtain and retain exceptional service was one of the underlying principles of success.

This is particularly true of the ones higher up—the officials, department heads, and superintendents. Depending upon the nature of the organization it is more or less true with foremen, for it is these men that are the "keymen" in industry—the direct link between production and management. A good superintendent or a good foreman may not be able to extract loyalty and efficiency from a bunch of crooks, radicals and loafers; but a poor foreman—the one who may be cowardly, loud mouthed, self-righteous, smug, insulting, or who is merely lacking in qualities of leadership—can ruin the best group of men that ever worked.

The good will of the employees is among the major assets of any company. It should be cherished by all men in executive or supervising positions. Such good will can not be obtained if the foreman is arrogant or spineless; a jolly good fellow or a snobbish clam. Good will among the men will be lacking if the foreman fails to merit both the affection and respect of his men.

THE DYE SITUATION ABROAD

NEW products continually making their appearance on the market account for the great difficulties which stands in the way of a general agreement among the chemical industries, according to the "Review of the Economic Aspects of Several International Agreements," prepared for the Secretariat of the League of Nations.

Aniline dyes receive considerable attention in the review, which is carried in part by the Times, but only as they are affected by the agreement between the producers of France, Germany and Switzerland.

"It has to be remembered," says the article, "that before the war Germany supplied 88 per cent of the world's requirements of dyestuffs. In comparison, France's production was small. The situation changed during and after the war."

The report to the League states that "the manufacture of chemicals is now regarded as an industry of boundless possibilities. Nearly all the great consuming countries which are at all industralized have endeavored to develop chemical industries, and especially an aniline dye industry of their own.

"The French dye industry was protected both by a prohibitive customs duty and an import prohibition. Germany could only support the French market by means of a complicated and limited system of licenses. These transactions related chiefly to products which France was unable to manufacture herself. For the rest, the French aniline industry was able to meet home requirements and, thanks to the liberal support granted by the State, it was soon in a position to export considerable quantities of certain ranges of goods.

"As France was determined to protect her dye industry, and as Germany could not tolerate this discrimination, an agreement between the two groups had to be sought in the sphere of private industry. The situation of the aniline dye industry had been particularly aggravated by the import prohibition then existing in England. On the German side, the negotiations were conducted by the I.G. Farbenindustrie A.G.; France's chemicals were grouped into a kind of syndicate, through which they negotiated, however, as independent undertakings.

"The agreement covers all aniline dyes and auxiliary products for dyeing processes, comprising several thousands of varieties. The inclusion of new products manufactured in the future is stipulated for."

The agreement, having far-reaching aims, is concluded for a very long period. The accession of new members from other countries is expressly allowed for; for instance, the countries to which it might be extended are Great Britain (Imperial Chemical Industries, Ltd.), Switzerland (Swiss I. G., Basle), and Italy (Acna, Milan).

The experts are unable to say yet whether the system on which the agreement is based will prove satisfactory or not. They do think, however, that the structure of the agreement seems to take sufficient account of present re-

quirements. The great difficulties which stand in the way of a general agreement in the chemical industries are chiefly due to new products continually making their appearance; "hardly has a satisfactory regulation of conditions of production and sale been reached," they say, "than new developments overthrow the whole system."

The report states that the German, French and Swiss groups anticipate that the agreement will lead to increased production, better sales, and financial benefits.

A Post-Depression Decalogue

AS we emerge from the depression—and authoritative testimony indicates that the upward climb is at last under way—there is a growing realization that once more, as in every period of trial, business has learned several salutary lessons.

Above all else perhaps this crisis has revealed, as none of its predecessors had, how closely interwoven the economic fabric of this nation has become during these post-war years.

In one of his first debates with Douglas, Lincoln observed that "commerce brings us together and makes us better friends. . . . These mutual commercial accommodations are the cements which bind together the different parts of this Union.
. . . They are the props of the house tending always to hold it up." And if that was true two generations ago, it certainly has become infinitely more convincing in this day of a vastly more intensive, closely integrated economic mechanism. Business is no longer on the lone-wolf, every-man-for-himself basis.

It might be interesting to tabulate very briefly a few of these impressions which come to mind as we contemplate the difficult road over which business has had to make its painful way during the past few months.

1. Don't blame the depression for everything which has marred the tranquillity of the economic scene since 1929. Lack of vision, archaic methods, antiquated policies, within individual firms and trades, have all contributed toward weakening those involved so that when the depression came it was but the last straw, the final episode in a long sequence of causes, rather than the fundamental reason for current difficulty.

2. Don't compare peaks with slumps. Both are abnormalities. The more we flatten out the peaks, the better will be our control of the slumps.

3. Don't fall into the fallacy so general among European industrialists of expecting the wage-earner to bear the brunt of the readjustment. There is plenty of slack elsewhere—careless production, inefficient management, slipshod selling. Talk of drastic slashes in American living standards and "permanent lows" in wages borders closely on economic lunacy.

4. Don't cut loose from associated activities in business. Such shortsighted "economy" is the sheerest extravagance at this particular stage of business readjustment. There never was a time in the last ten years when cooperation was more invaluable.

5. No peril is quite so disastrous in business these days as a smug, self-satisfied assurance that present technique in production will be permanent. Our engineers, our chemists, our inventors, have never shown such relentless zeal as at present. They have largely been responsible for lifting the country out of every preceding crisis. Those industrialists who cling closely to them right now will have good reason to be thankful.

6. Don't cut marketing research. Our gravest deficiency still lies in the field of defective distribution. Our major business problem these days is not what can be made, but what can be sold. If the billions wasted there could be salvaged, even in a modest proportion this year, it will be the largest single contribution to our recovery. Closely associated with this is the need of sustained, far-sighted advertising as an invaluable adjunct to more effective and economical distribution.

7. Don't overlook the stabilizing value of foreign markets. They can not be exploited on short notice. Many a firm has survived this recent storm because its executives had the foresight in fair weather to plant an anchor in two or three carefully selected markets far overseas.

8. Don't fall again into the perils of mass mania, the delusion that the sole purpose of business is "busyness." Quantity operations whether in output or distribution are by no means an invariable assurance of quantity profits. The dinosaur was a first-class example of mass production. But he and his kind have all been quite dead for several million years because too much of their "mass" was below their ears.

9. Don't overlook the perils of obsolete equipment. It is wiser to have the junk heap outside the factory than in it. Nearly half (48 per cent to be exact) the machinery in our own American factories today is over ten years old. The paralysis of advancing senility is all the more dangerous because its stealthy approach is so painless, so easy.

10. Don't be stampeded by unfounded rumors. They are the fodder on which crises flourish. In these days of abundant, accurate statistical data and superb communication facilities, there is no longer any valid excuse for mischievous gossip-peddling among other wise sensible business executives. The mendacity of every irreponsible, dangerous rumor can be and should be instantly squelched. And it will be, as long as ours is still a business leadership of men, not mice. The time for the calamity complex has passed.

From an address by Dr. Julius Klein, Assistant Secretary of Commerce, before the Manufacturers Association of Bridgeport, Connecticut.

Wooden Vessels in the Dyehouse

By **FRED. GROVE-PALMER, A.I.C.**

DESPITE the introduction of various non-corrosive metals for the vats, becks and other vessels used in the chemical side of the textile industry, wood still retains its popularity. There is something substantial about a wooden tank that carries conviction and wins confidence in a way that no other substance can. In a way it is a relic of the past but it is one that has stood the acid test of experience and has come through a winner.

Durability, without giving rise to trouble in upkeep, is what is looked for in dyeing tanks; there are three factors that make for this, each of equal importance; they are: the design of the vessel, the materials of which it is composed, and the skilled workmanship that goes to the making.

If the design is not good, the vats will not endure so long as might be expected because there will arise constant strains and stresses tending to pull it out of shape and cause lack of stability.

If the lumber used is not specially adapted to the purpose there will be warping and over-swelling; these will cause distortion and also disintegration of the wood. In the case of the hoops or tierods, unless these are suited to the purpose for which the tank is intended, they will be corroded and need renewal.

When the workmanship lacks the necessary skill and experience the tanks will always be leaking and calling for caulking, causing much inconvenience and expense in upkeep. Frequent tightening of the hoops will be required which is not good for the tank if it is done by half-skilled workers, while bringing in experts is oftentimes a costly proceeding.

The building of large wooden containers is not an easy matter; it requires long experience and much knowledge of the best sorts of lumber for each purpose. The dyer, himself, may be able to give valuable information on the subject of hoops and tierods but it will be the tank maker who can apply that knowledge to the best advantage. The subject of linings when required contains many points that wide experience can settle, while the matter of choosing the best shape for a tank of given size needs careful consideration. From all this it will be seen that the best way of getting satisfaction for the money expended is to place the supplying of wooden dye vats and tanks in the hands of a firm which specializes in the work and has a reputation to live up to.

Why Use Wood?

There are several reasons, quite apart from first cost, why lumber is a suitable material for making dyehouse tanks, better than some of the others that are commonly used. First may be mentioned the matter of upkeep. Wood needs little care and does not call for painting to preserve it from rust. The thickness of the wood, being a good non-conductor, prevents radiation of heat; consequently the temperature of the liquors is maintained at the desired figures without much expenditure of steam. Hard waters do not produce layers of flaky carbonate on wood as they do on lead; this substance is sometimes troublesome and certainly implies corrosion of the lead, but wood is unaffected. Within certain limits the ordinary corrosive liquids used in and around the dyehouse have no action upon properly seasoned lumber, though boiling dilute acids will attack sappy wood and destroy it the action is not so violent as it would be on iron or steel, nor are the goods in such a tank open to being stained by "iron-mold." There are non-corrosive metals, alloys or steel or copper that will withstand the action of practically every chemical; these are excellent but they are much more expensive than wood. Many chemicals can be stored in wooden vessels that would be contaminated if kept in anything else. Vitreous enameled steel tanks are good so long as the enamel does not crack and flake off, giving rise to iron stains on the fabric. Glass and acid-resisting stoneware are also useful, but there is always the risk of fracture from some outside agency, while frost and extreme heat are both apt to cause breakage.

A well made wooden tank is perfectly watertight; if it is not there is reason to grumble at the workmanship and to call upon the makers for an explanation. In some cases it is necessary to line a tank if it is to contain a fluid of so corrosive a nature that the lumber would be eaten away. Sheet lead is most commonly used; it should be fitted by a plumber who understands the work. Copper is sometimes used though not so much now as in the past because the wider range of chemicals now employed in connection with the dyehouse has introduced some that act upon the metal and give rise to stains. Some or other of the rustless steels, monel metal or similar alloys have to a great extent replaced copper. Earthenware tiles give good service if securely fixed, so do asphalt and specially prepared rubber, each in its own sphere of usefulness.

Many users of wooden vats consider that those of cylindrical shape are more lasting than rectangular ones because they are more readily tightened up and braced. It will often be found that it costs less to buy a "round" tank than a "square" one when the order is placed with a concern doing big business in this line. Although there is practically no limit to the size in which a wooden tank can be made, it will easily be seen that it is more economi-

cal to specify sizes that can be made from standard lengths of lumber without cutting to waste. The maker can give information on this matter that should be strictly followed.

The hoops of round tanks are usually made of wrought iron, but other metals can be substituted as the use of the vessel may dictate.

Sorts of Lumber

Several different sorts of lumber can be used for making cylindrical vessels, some far better than others. In this regard it is as well to mention that the methods of naming woods is very haphazard and misleading, the same or similar names being applied to very different timbers. This is apt to cause confusion and may lead to serious errors; a suggested remedy is to make use of the somewhat clumsy but certainly more definite botanical names of the trees intended. Woods commonly known as cypress, white fir or spruce and yellow pine are, in that order, the best for the purpose.

Cypress is *Taxodium distichum*, often known as "bald," "swamp," "marsh" and Louisiana cypress; another name is "Red Gulf" cypress. It grows in Louisiana and others of the South-Eastern states and also in Central America. It should not be confused with the ordinary Mediterranean cypress (Cupressus sempervirens) which is a cedar-like, close-grained wood of reddish color. Swamp cypress grows up to 170 feet high and may measure 15 feet in diameter; as its names imply it flourishes in wet ground and the lumber, which is soft, straight grained, light in weight and easily workable, has great durability in the presence of water. In addition to its employment for dyehouse tanks it is also used for conservatories, railroad ties, fences and other constructional purposes where contact with moisture is apt to be permanent. Cypress has been described as the most popular wood for tanks in the American textile industry.

White fir (Abies or Picea excelsa) may be called spruce, white deal, etc.; it grows to a height of 100 feet or more and the lumber varies in color from a bluish white to a brown-yellow. It is soft and works easily, is full of black knots, and has this peculiarity of growth that the sapwood is not readily distinguishable from the heartwood. Only the very best quality is good enough for chemical tanks.

Yellow pine (Pinus palustris) is also known as Georgia or long-leafed pine. It is very good for making tanks. Growing to a height of 120 feet, the lumber is close-grained and resinous, durable and capable of taking a fine polish. It has considerable value for the making of paper mill tanks which are often of the largest sizes; much is exported. Although it is not so lasting as cypress and is not suited to all purposes, it is very useful for many chemical liquors and will withstand the action, particularly, of sulphuric acid.

Another yellow pine (Pinus strobus) is also known as American yellow pine, and sometimes Weymouth pine; it grows 200 feet high with 10 feet diameter and varies from pale yellow to white in tint. It is easily worked though on account of the fact that it will not retain nails very well; it is more valuable to joiners than to carpenters.

Whatever may be the sort of lumber decided upon for dyeing becks, boiling vats or kiers, storage tanks, and the like, it is absolutely essential that it shall be thoroughly seasoned. Further allusion will be made to this important matter because it is only by choosing such wood that shakes, cracks, splits and honeycombs can be avoided. Perfectly sound lumber must be used and this matter should be kept prominently in all discussion concerning the making of tanks.

Cypress is undoubtedly the best of the four kinds of lumber to which allusion has been made here for all the purposes of the textile industry. Firstly, it is the most durable of all of them. There are many trees which give good, lasting lumber in their own part of the country but when they are shipped to another in which the climate is different they give rise to great disappointment. But this cannot be laid against swamp cypress; it will give good service no matter where it may be used, and personal experience with it in various parts of the world has convinced one that there is no risk involved in placing it at the head of the list of useful trees for dyehouse purposes. There is no difficulty in understanding the reason for it; the tree grows in marshy districts; it might almost be described as an aquatic plant. The wood is formed in such a way that the cellular arrangement will stand being constantly wet, consequently it is ideal for tanks that are to hold liquids. There is little or no swelling or shrinkage with either hot or cold liquors; it resists alkaline baths as well as acids; it will not contaminate the contents either by coloring, taste or odor, and is therefore useful in all kinds of food products, including drinking water, vinegar, cider, fruit syrups, etc.

White fir has some of the same qualities as cypress though it is not so durable, but as it is much cheaper that is to some extent set off when initial expenditure has to be considered.

Conical vats in which the taper is downward should be avoided whenever possible; it is very difficult to prevent the hoops from slipping and it is awkward to tap them up tightly, while the insertion of nails or hooks to retain them in position causes destruction of the staves. Such tanks are not well suited to lead-lining owing to the tendency of the metal to creep downwards and so cause bulging. When the vat is heated the air behind the bulge is expanded and increases the distortion. When this does occur, it is necessary to have the plumber pierce the "bubble" and welt the lead back into place again. Lined tanks should be right cylinders and the hoops should be of a type that can be tightened up when requisite by some one from the engineer's department instead of calling in a cooperage expert or one of the tank maker's employes. The hammering of hoops to tighten them is apt to jar the lead loose, or to crack a lining of more resistant material.

The need to have wooden vessels made by highly skilled experts cannot be too strongly emphasized; it costs very little if any more because such people have many ad-

vantages whereby they can reduce their overheads and so give lower prices. The firm will either send the knocked down tank to the mill to be erected by the customer's own men or will send an erector gang to do the work. Except in special cases it is better to incur the small additional expense of having the maker's men come around and put the tanks up; he knows just where he gets off and the responsibility cannot be shoved onto other shoulders.

It is as well to ask for a blue print or a tracing of the foundations required for the tank. It is probable that the greater part of the leakages that occur from wooden becks arise because the foundations have not been studied sufficiently expertly. Quite a number of otherwise respectable men fail to give enough thought to the base upon which their tanks are to rest. Especially if the size and weight are large the designing and planning of the foundations should be placed in the hands of a competent engineer who has had experience in the work. It is not a matter than can be left to chance and the working out of book-formulas; there, too, many special problems attaching to it for any who has not done similar work to be able to handle it with confidence and safety. It is no manner of use looking at the wreckage caused by 100 tons of tank and water falling through the dyehouse roof and saying "I am sorry but my foundations were not right." They will probably have guessed that.

A minor point in the erection of cylindrical tanks, but one which it is well to keep in mind, is the arrangement of the couplings of the hoops. When wrought iron rod is used for the hoops and the ends are passed through malleable iron couplings, these are generally spaced spirally round the circumference. Flat hoops which are coupled by means of lugs with connecting rods usually have the lugs arranged vertically. It does not really matter but it keeps the appearance of the plant neat and tidy and, therefore, from its psychological effect upon the operatives, is worth considering. Riveted hoops should not be used, as tightening them up is a cooper's job if it is to be done well.

Round wrought iron hoops should have the threads machined on the ends, not rolled on, because they too have to withstand immense strains. Steel is more apt to rust. The hoops should have a coat of paint before fixing. They may, however, be coated with a layer of sheet lead or be sprayed with a non-corrosive metallic coating or, again, be covered with hard rubber, when the contents of the tank will be dilute acid of a nature that will destroy unprotected metal. The plan of supporting the hoops away from the stave on small wedges of wood to allow the overflow to trickle down between tank and hoop, is not a good one as it prevents the pressure of the hoop from being applied equally all around the tank.

Wooden vats and becks in the dyehouse are not painted on the exterior in a general way though sometimes a battery of kiers may be painted white with good effect. Storetanks outside may be given two coats of high grade lead and oil paint with advantage as a protection against weathering. The tarring of such tanks should be strongly deprecated; in that condition they are merely a blot on the landscape and a sign that the owner lacks imagination. When we are dong much to try to beautify the countryside and the roads, mill owners should do their bit and cut out tar. If the expense can be borne, a good spar varnish on the wood permits the real beauty of the lumber to be seen. The interior of a wooden vessel should never be painted; if there seems to be a necessity for it, the workmanship is at fault and the maker should be called in to put the matter right.

Of course, it may happen that a tank, especially one that has seen better days, may spring a leak. We have sometimes stopped such by throwing in some oak sawdust and letting the water drain away via the leak. The sawdust gets drawn into the opening and fills it up. Caulking with oakum and white lead or other suitable composition may be indicated but unless there is previous experience it is usually better to call the man who does know the best way. Tinkering often does more harm than good; an unstable tank containing some hundreds or thousands of gallons is a serious proposition.

In putting out an order for a new cylinderical vat it is well to put the figure for capacity well on the high side; the time will always come when it could be wished that it would hold a little more. The comparative costs of a size larger and a new tank weigh heavily in favor of the first. When ground space has to be considered, the diameter should be given as well as the contents. An easy method of calculating the height of the vessel is to divide the number of gallons by 5.2 to get the cubic feet, divide this by 3.1412 (pi), and again by half the diameter squared (R^2); this will give the height of the walls in feet. The mathematicians may have much better ways of getting at it, but this is a practical method adopted by some of the makers. The table below shows a few sizes calculated on right cylinders; in normal work there is a taper of one inch per foot run of stave which decreases the contents to some extent. This should be remembered in ordering, as indicated above, so as to allow for all contingencies. The figures denote inside measurements.

TABLE

Contents (Right Cylinder) Gals.	Diameter of Bottom Feet	Depth Feet	Number of Hoops	Size of Timbers Inches Square
158	3.0	3.0	3	1½ or 2
226	4.0	2.5	3	1½ or 2
526	4.5	4.5	4	1½ or 2
794	5.0	5.5	5	1½ or 2
1,145	6.0	5.5	5	1½ or 2
1,592	6.5	6.5	6	1½ or 2
4,000	9.0	8.5	7	1½ or 2
5,530	10.0	9.5	8	2
7,956	12.0	9.5	8	2 or 2½
12,320	12.6	15.5	14	2 or 2½
20,180	16.0	13.5	12	2.2½ or 3
43,200	19.6	19.3	21	2½ or 3
123,380	30.0	23.3	37	3

Rectangular Tanks

As a general rule the becks or tubs in the dyehouse are rectangular, that shape being more convenient for the working of many processes. It would appear at first sight that such a tank should be easier to make than a round one, and so it is, provided there is the necessary knowledge of first principles and the experience in applying them. The strains and stresses occurring in a "square" tank are greater than in the others because each individual member of the sides and bottom does not give and receive the same mutual support as is found in the staves of the cylinder. When this fact is understood, given the necessary technical skill, the making of a square tank does not involve very much difficulty, and many textile mills habitually turn out all they require without calling in outside assistance.

The lumber used is of the same kinds as those already named with the addition of pitch pine, teak, oak and redwood. Teak is fine wood, hard and lasting, but it is very costly and probably does not get used very frequently. An objection to both oak and redwood is that they are apt to discolor the fabric especially when new; certain active principles are dissolved and extracted from the wood, and react with the dyestuffs. For ordinary use, therefore, these woods should not be employed. If the becks are to be used only for blacks slight extra coloration from the wood might not matter so much.

The members of square tanks need to be braced together with tierods; wrought iron is generally used but other metals can be employed if preferred, always remembering that when acid liquors overflow the rods may be attacked.

In connection with acids generally, it should be borne in mind that when the baths are likely to be used for inorganic acids in greater concentration than 4 per cent they should be lined with lead or other metal, as wood will not withstand such action. Organic acids on the contrary, can be kept in wood to almost any strength, provided it is properly seasoned. As mentioned before, sappy wood soon gives way.

Not infrequently, wooden becks are seen with a tierod across the center; this should always be avoided because it is continually getting in the road of the material while working, and furthermore, the drips from it will cause discoloration of the fabric. Becks that have a central partition with a tierod along the top are not, perhaps, so open to this objection but, even in this case, it is better to lay the rod in a groove sunk in the top of the partition and cover it with lead or a hardwood fillet.

When properly made with due regard to strength and resistance to stresses, the interior measurements of a wooden tank will run just about one foot less than the length of the lumber used. Normally, standard lumber suitable for the purpose runs in lengths of even feet; it is consequently more economical to make the tanks with internal measures in odd feet. For instance, 10 ft. and 6 ft. lumber will make a tank measuring 9 ft. by 5 ft. without cutting to waste.

Rectangular tanks can be purchased from firms who specialize in their manufacture; they are shipped ready for erection and do not entail much trouble; dyers often make their own if "Chips" has a flair in this direction. The individual members of sides, ends and bottom are held together by means of iron rods slid through holes bored in the lumber. It is usually better practice if the top nuts of the sides and ends are countersunk, with a coping of hardwood fixed along the edge. This will prevent wet material from coming into contact and getting either torn or stained. The lower nuts do not matter in this respect; though it might prolong their life if they were protected they generally last so long that it is doubtful if it is worth the extra trouble involved.

The bottom is crozed to take the sides and ends; the sides are crozed to take the ends. The crozings (grooves) should be so cut that the members make a driving fit; when the lumber swells the whole becomes watertight. Stability is gained by fixing tierods through the sides across the ends, passing through bracing stays. In long tanks that are to hold a large bulk of liquor there is sometimes a tendency for the sides to bulge; this may not be noted when the vessel is new but as time passes it becomes evident. It may be cured or, better, prevented by putting a tierod down the length of the tank, on each side, and driving a hardwood wedge in the center. This truss has the effect of pressing the bulged wood back into place when the rod is tightened.

In practice it is often found that small becks only need to have the bottom rodded; it is sufficient if the sides and ends are doweled but this should never apply to tanks over 2 ft. 6 in. deep. These should always be vertically rodded, three or five for the sides and two or three for the ends, depending on the length of the lumber. The spacing of the tierods for the ends should run roughly around one per foot after the first foot of depth; in other words, a vessel up to 2 feet deep will have one tierod; one up to 4 feet will have three rods, and so on in proportion.

Sheet lead and hard rubber are the most usual materials for lining square becks that have to hold corrosive fluids; asphalt is sometimes used. It is very useful though it has its limitations. It is better to use natural asphalt for this purpose and not that made by the gasworks. The filling, too, should receive consideration; powdered limestone, for instance, would be avoided if the tank is to hold acid. When it is desired to protect fabric from chance discoloration arising from the wood, the inner surface of the tank may be impregnated with paraffin wax or ceresine; this would only be of any permanent value if the contents are to be kept cold; if steam is used the wax will be softened and gradually wiped away.

Such is the importance of well seasoned lumber, that further allusion to the matter will be pardoned. Wood containing sap will shake, shrink and warp; the tank will be distorted and will spring a leak. Much lumber is dried artificially in kilns, "dry-seasoned" they call it, but

experienced users maintain that when so treated it loses much of its virtue. It may be held that this is largely a matter of old-fashioned prejudice but it is not well to dismiss the matter thus casually. There is more in the "nature" of wood than the rigidly scientific tests can show; the man who knows wood from years of handling can give information about it that the laboratory never discovers, and it is well not to disregard it. There is not any doubt that naturally seasoned wood gives more lasting results in tank.; it is more stable and less brittle than dry-seasoned. The lumber for the purpose should have been stacked in such a way that there is free access of air all around while the ends are protected, partially at least, from the action of sun and high winds; in this way the drying out is thorough and gradual, especially if the ground beneath is well drained. The drying action is accelerated by previously soaking in running water for a fortnight or so, the sap being partly dissolved out, but sea-water should not be used for chemical tank wood. As to how long the lumber should have been seasoned it is not possible to lay down any definite figure; everything depends upon the nature and size of the baulks, the climate and the method of stacking. When buying wood for the making of vessels for the dyehouse it should be entrusted to one who really understands; a good purchasing agent may not necessarily be a wood expert. Experience will tell from the ring of the wood when it is given a blow from the back-end of an ax whether it is properly seasoned or not, and fit for the purpose intended.

Wooden tanks should never rest immediately upon brick or concrete foundations but should be supported on joists allowing free passage of air underneath; this prevents rotting. In the case of round vats, the joists should support only the bottom, not the ends of the staves. The joists, sometimes called "dunnage" or "stillage," neither name is very good, must run at right angles to the joints between the bottom planks, and should allow a clearance of at least two inches at each end from the staves; they should be not more than 1½ feet apart in order to present a perfect leveled surface to take the whole weight of the filled tank.

If the matters here detailed receive attention the life of new wooden vessels, as well as those which have been in use for some time, will be considerably lengthened.

Providence Testing House

The United States Testing Co., Inc., on March 2, moved its New Bedford Testing House to Providence, R. I. It will be designated as the Providence Testing House. The facilities of the new testing house permits tests of yarns, fabrics, mill supplies, and general laboratory service for all branches of textiles. J. K. McWilliam, who has been the manager at the New Bedford Testing House since its inauguration 11 years ago, will continue in that capacity at Providence.

A Happy Ending

I

He started in the dye house,
When he was in his teens.
All colors looked alike to him,
From Purples back to Greens.

II

He weighed dyes of all descriptions,
And he slaved thru steam and wet,
Was poisoned by deadly chemicals,
But the Lord still spares him yet.

III

For now he's a master dyer,
With a million troubles too.
From the super to the colorist,
Trouble always seem to brew.

IV

Now I'm wondering when he's passed away,
To the land whence none return,
Will he at last be happy,
Where hence he was stiff and stern.

V

Now I'm sure God will know of his ills and cares,
When he trod on the earth beneath,
And when he reaches the Golden Shore
They'll crown him with a wreath.

VI

And I hope St. Peter will grasp his hand,
Also tell him to grin and yell
For the super and buyer just came up
And I've sent them both to hell.

S. A. Berry

New Aromatic Products

Givaudan Delawanna Inc., manufacturers of aromatic products, have just introduced to the textile industry a series of three deodorant materials which are recommended to be used in conjunction with finishing oils or pastes in order to offset the unpleasant odor which is caused by many types of finishes, especially after the goods have been stored for some time.

These products are marketed under the name of Tex-O-Dors, and are said to be remarkably tenacious and powerful blends.

Tex-O-Dors have been offered to the textile trade as a result of more than twelve months' experimental work with all types of aromatic products in conjunction with various finishes.

They meet a growing demand in the textile industry for products which will neutralize objectionable odors or even give a new scent to the finished fabrics, be they silk, rayon, cotton or woolen.

The General Dyestuff Corporation has issued a revised pattern card entitled "Celliton, Celliton Fast, Cellit, Cellit Fast Dyestuffs and Cellitazols on Acetate Silk." The card shows dyeings on yarn and piece goods. I. G. 2.

Southern Textile Exposition

Nineteen months hence the tenth Southern Textile Exposition will be held in Textile Hall. The dates have been definitely confirmed, namely, October 17th to 22nd, 1932. This is a little earlier than the exposition last year. The weather at this time in the autumn is usually balmy and pleasant.

Practically three-fourths of all the available space has been applied for. Allotments will not be made until this summer, after all applications have been plotted on the diagrams. There will be large exhibits of spinning and other major operations. Doubtless many new improvements will be perfected in all lines of textile machinery in the next year and a half.

The management of the exposition are making their preliminary plans for the most attractive show ever held. The same executive officers of Textile Hall Corporation who planned and directed the last show will be in active charge. Arrangements for the comfort and pleasure of visitors will be the most extensive ever undertaken.

Pontamine Fast Orange EGL

The Dyestuffs Department of E. I. du Pont de Nemours & Company has announced Pontamine Fast Orange EGL, a direct dyestuff producing brilliant shades of orange slightly redder than those obtained with Pontamine Fast Orange EG. It is said to be characterized by excellent solubility and extremely good level dyeing properties, along with good fastness to light, chlorine, hot pressing, perspiration and rubbing.

Pontamine Fast Orange EGL may be dyed on cotton rawstock, yarn or piece goods and is applied not only in self shades but in combination with other direct colors having the same characteristics, for the production of browns, tans and grays.

On pure silk, Pontamine Fast Orange EGL is said to yield bright oranges of equal fastness to the shade obtained on cotton and it is sufficiently fast to light to be used on silk and rayon draperies and upholstery material.

U. S. Testing Laboratory

A branch testing laboratory at Scranton, Pa., was opened by the United States Testing Co., Inc., on March 2. It is known as the Scranton Testing House. It makes possible for the mills in the district a considerable reduction in shipping costs as well as a saving in time, according to officials of the Testing Co. Arrangements may be made, it is stated, to have sampling done directly at the mill. Thrown silk will be sampled, sealed and sent direct to destination. Walter I. Holt is in charge. Mr. Holt was assistant manager for the company for six years at New Bedford, three years at Chicago and for the past two years has been serving in that capacity at Hoboken.

Summer Colors

Sixteen new colors for Summer will shortly be sent out to members of the Textile Color Card Association in confidential swatch form, it was announced by Margaret Hayden Rorke, Managing Director. The Mid-Season Card, portraying these shades, will be issued soon after.

This special Summer group will reflect recent color developments in fashion and will include certain shades highlighted at the Paris openings. It was pointed out by Mrs. Rorke that the new colors supplement but do not lessen the style value of shades already appearing on the Association's 1931 Spring Season Cards, which served as the foundation for trade-wide color coordination.

It was further explained that many colors appearing in the Spring cards were stressed at the recent openings. These include Admiralty, Guardsman Blue, Singalee and Indies Brown, Sea Sand, Sky Grey, as well as sports shades and accent notes, such as May Bud and Blue Jade, Stargold and Lime Yellow, Seashell Pink and Corail, Wildfire and Flame Red.

The Summer colors will reflect the newest interpretations in clear vibrant shades adaptable for sports and evening wear, as well as accent notes for carrying out smart color contrasts.

Also represented in the collection are several new renditions of animated pastel tones, as well as a group of four delicate attenuated nuances including "face powder" tints.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED

Boss dyer—38 years of age and married, with sixteen years' experience on piece silk; pure-dye, tin-weighted and mixed goods; best references; would consider position anywhere in the Untied States or Canada. Full information upon request. Address: Classified Box No. 664, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Graduate Chemist and Dyer—Two years' teaching same, three years chemist, last twelve years dyer, desires position. Experienced on cotton warps, skeins, rayon, package dyeing and mixed fibers. Applying directs, vats, sulphurs, developed and after-treated dyes. Familiar with bleaching and mercerizing. American; thirty-nine; married. Address: Classified Box No. 667, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.